VOLUME II

PROJECT MANUAL

FOR:

Phase 2 – Bond Improvements

At

Fox Lane HS, Fox Lane MS, Administration Building

BEDFORD CENTRAL SCHOOL DISTRICT
TOWN of BEDFORD, WESTCHESTER COUNTY

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B.B.S. PROJECT NUMBER:

23-131 A-C

BID PICK-UP DATE:

February 24, 2025

ARCHITECTS CERTIFICATION

THE UNDERSIGNED CERTIFIES THAT TO THE BEST OF HIS KNOWLEDGE, INFORMATION, AND BELIEF, THE PLANS AND SPECIFICATIONS ARE IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE NEW YORK STATE UNIFORM FIRE PREVENTION AND BUILDING CODE, THE NEW YORK STATE ENERGY CONSERVATION CONSTRUCTION CODE, THE CONSTRUCTION STANDARDS OF THE EDUCATION DEPARTMENT, NEW YORK STATE DEPARTMENT OF LABOR RULE 56, EPA AND AHERA REQUIREMENTS.

TABLE OF CONTENTS

VOLUME I

DIVISION 00 – FRONT END DOCUMENTS

DIVISION 01 – GENERAL REQUIREMENTS

DIVISION 02 – EXISTING CONDITIONS

TABLE OF CONTENTS

VOLUME II

DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

DIVISION 05 – METALS

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 – OPENINGS

DIVISION 09 – FINISHES

DIVISION 10 – SPECIALTIES

DIVISION 11 – EQUIPMENT

DIVISION 12 – FURNISHINGS

DIVISION 13 – SPECIAL CONSTRUCTION

(Not Applicable)

DIVISION 14 – CONVEYING EQUIPMENT

(Not Applicable)

DIVISION 21 – FIRE SUPPRESSION

DIVISION 22 – PLUMBING

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

DIVISION 26 – ELECTRICAL

DIVISION 27 – COMMUNICATIONS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

DIVISION 03 – CONCRETE

SECTION 030100 – CONCRETE SURFACE PREPARATION FOR COATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work under this Section of the Specifications shall consist of furnishing all labor, materials, equipment, and appliances necessary or required to furnish and install all work of this Section and other related work in connection with cleaning and preparation of concrete to provide a clean, contamination-free surface suitable for the application of coatings.

1. The Contractor shall remove all water, dirt, paint, grease, oils, loose concrete, and previous coatings from the surfaces to be coated to the satisfaction of the coating manufacturer and the Architect.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.03 RELATED SECTIONS

A. If concrete reconstruction is required on job prior to coating:

1. Section 030130 – Concrete Reconstruction and Resurfacing
2. Section 030130.11 – Cementitious Concrete Finish Coating; *OR*
3. Section 030130.12 – Elastomeric Concrete Finish Coating; *OR*
4. Section 030130.13 – Acrylic Concrete Finish Coating

1.04 APPLICABLE STANDARDS

A. ASTM Standards:

1. D4258 - Practice for surface cleaning concrete for coating.
2. D4259 - Standard Practice for Abrading Concrete.
3. D4285 - Test method for indicating oil or water in compressed air.

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. The Contractor shall submit the cleaning procedure, in accordance with this specification, outlining methods, equipment and materials to be used for cleaning of concrete to the Architect for approval prior to the commencement of work.

C. Submit manufacturer’s data for products including application instructions.

D. Contractor shall perform full cleaning procedure on a selected sample area to verify acceptability prior to proceeding with full scope of cleaning.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Steam Cleaning: Remove heavy deposits of grease and oil as well as other water-soluble surface contaminants and emulsifiable materials with a jet of high-pressure steam in accordance with ASTM D4258.

B. Detergent water cleaning may be performed in lieu of steam cleaning provided the contractor demonstrates that the proposed product(s) and procedure yields similar results to steam cleaning that are acceptable to the architect.

C. Detergent water cleaning shall consist of scraping of heavy deposits of grease or oil and cleaning the surface with a stiff-bristled brush using an aqueous solution of detergent or non-solvent emulsifier. Immediately after treatment, before the surface dies, residues of the cleaning agent shall be removed by thoroughly flushing the surface with clean potable water.

D. Prior to detergent water washing, provisions must be made for the removal of waste wash water and contaminates generated by this cleaning method.

E. The use of acids for cleaning or preparing surfaces is not permitted.

F. Correct fins and protruding irregularities by mechanical means.

3.02 ABRASIVE BLAST CLEANING:

A. Abrasive blast cleaning is required when the Surface Preparation above is alone insufficient to provide a clean, acceptable surface for coating or if abrasive blasting, sand blasting, or shot blasting is specifically required by the Drawings or other specification sections. In any case, all costs associated with abrasive blast cleaning shall be borne by the contractor and included in the bid.

B. Clean concrete surfaces in accordance with Surface Preparation section above.

C. Erect temporary containment barriers suitable to the project to capture all spent blast media and particulate matter.

1. The Contractor shall be fully responsible for any and all contamination to adjacent properties and shall clean and make all necessary repairs to same at no expense to the Owner.

D. Concrete surface may be wet or dry as appropriate to the type of equipment to be used.

E. Apparatus: Typical methods are wet or dry open blast cleaning with nozzles and self-contained recirculating blast cleaning apparatus.

F. The compressor shall supply a minimum pressure, in the hose, of 620 KPa within 36” of the nozzle.

G. The air stream used for nozzle blast cleaning shall be free of oil, verified using ASTM test method d4285.

H. Nozzles shall be a minimum of diameter of 8mm.

I. Hoses shall be a minimum inside diameter of 40mm.

J. Abrasives shall be metallic, garnet, or resin-coated silica sand. Uncoated silica sand is specifically disallowed.

K. The intent is to remove sufficient material in order to achieve a sound concrete or masonry surface free of existing coatings, laitance, glaze, efflorescence, and incompatible concrete curing compounds or form release agents.

3.03 POWERWASHING

A. Powerwashing may be performed in lieu of abrasive blasting provided the contractor demonstrates the proposed procedure yields similar results to abrasive blasting that are acceptable to the coating manufacturer and the architect.

B. Clean concrete surfaces in accordance with Surface Preparation section above.

C. Apparatus shall be a piston-type positive displacement pump, high-pressure water blasting unit.

3.04 APPEARANCE OF PREPARED CONCRETE SURFACE

A. Concrete surface shall have a minimally roughened texture. A roughness standard shall be established by mutual agreement between the Architect and Contractor.

B. Some aggregate may be exposed and bug holes shall be opened.

C. Post-preparation cleaning: Clean in accordance with ASTM D4258 to remove loose material.

3.05 INSPECTION

A. Visually examine the prepared surface for loose adhering concrete, thin crusts bridging voids, fins, and projections.

B. Visually examine the prepared surface for paint, oil, grease, and markings.

3.06 ACCEPTANCE

A. Acceptable surface shall be free of paint, laitance, oil, grease, and other materials incompatible with the coating. The surface shall also be free of fins, projects, and loosely adhering, concrete, dirt, and dust particles.

B. The surface shall have a smoothed, textured appearance, roughened only where unavoidable. Aggregate may be exposed, only where unavoidable. Bug holes shall be opened.

C. The resulting surface condition must allow the coating manufacturer to provide acceptance in writing. Cleaning, abrasive blasting and/or powerwashing must be repeated as required to obtain acceptance.

D. The final appearance shall be similar to the standard established by mutual agreement between the Architect and the Contractor upon review and acceptance of the sample panel cleaned under 1.05.D.

END OF SECTION

DIVISION 03 – CONCRETE

SECTION 030130 – CONCRETE RECONSTRUCTION AND RESURFACING (NON-STRUCTURAL)

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work under this Section of the Specifications shall consist of furnishing all labor, materials, equipment, and appliances necessary or required to furnish and install all work of this Section and other related work in connection with non-structural concrete reconstruction and resurfacing as shown on the drawings and/or specified herein.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.03 RELATED SECTIONS

A. If finish coatings are required on job:

1. Section 030100 – Concrete Surface Preparation for Coating
2. Section 030130.11 – Cementitious Concrete Finish Coating; *OR*
3. Section 030130.12 – Elastomeric Concrete Finish Coating; *OR*
4. Section 030130.13 – Acrylic Concrete Finish Coating.

1.04 SUBMITTALS

A. Comply with the requirements of Section 013300 – Submittal Procedures and as modified below.

1. Submit manufacturer's product data, specifications, installation instructions, MSDS, and samples for each component.

2. Submit two (2) copies of the manufacturer's guarantee agreeing to replace coatings and repair materials in the event of failure in materials or workmanship for five (5) years from within 12 months of date of acceptance.

1.05 QUALITY ASSURANCE

A. A representative of the manufacturer of the protective coating, other than the contractor, must be present at the site during the initial application of the protective coating and periodically thereafter, at intervals to be approved by the Architect.

B. Upon completion of this work, the Contractor shall secure a letter of certification from the manufacturer that all work has been done to the product manufacturer's satisfaction. This letter of certification must be filed with the Architect before final acceptance.

C. Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. All workmen involved in the application of the coating shall have received training by the manufacturer.

PART 2 - MATERIALS

2.01 MANUFACTURER

A. Design is based on the use of products as manufactured by Sika Corporation and the terminology used may include reference to that manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

1. Materials:

a. “Sika Armatec 110 Epocem”; a solvent free, epoxy-modified, cementitious, anti-corrosion coating for reinforcement steel.

b. "SikaRepair SHA with Latex R"; a two component, polymer modified cementitious repair mortar, for all vertical and overhead hand applied applications.

c. “Sikacrete 211 SCC Plus”; a one component, polymer modified, silica fume enhanced, self-consolidating, repair mortar with an integral migrating corrosion inhibitor, for form and pour applications.

d. “SikaQuick 1000”; a two component, polymer modified cementitious repair mortar, with a migratory corrosion inhibitor, for horizontal concrete repair applications.

2. Alternate acceptable product: "SW-82" or "SW-88" latex modified repair mortar and other associated primer and repair products as manufactured by Strongwall Industries, Inc.

2.02 PRODUCT DATA

A. **Sika Armatec 110 Epocem**:

Two coats of are required for protection of reinforcement steel. Sika Armatec 110 Epocem is recoatable generally 2 hours after the initial application. Application of concrete repair materials may also proceed at this time. At elevated temperatures, the re-coat and overlay times will be reduced. The minimum application temperature for Sika Armatec 110 Epocem is 40°F (5°C) and rising. Consult the technical data sheet or the local Sika Corporation office for further information.

1. Properties:

Test Method	Typical Result
Density mixed:	125 lb/cu. ft.
Recommended thickness per coat:	20 mils
Total application thickness;	40 mils
Drying Time @ 73°F (20°C):	2 hours
Color:	Concrete Grey
Pot Life:	90 minutes
Time to Corrosion Study	40% corrosion reduction

*All application and performance values are typical for the material but may vary because of variations in test methods, conditions, and configurations.

B. **SikaRepair SHA with Latex R**:

SikaRepair SHA with Latex R may be applied in sections up to 3 inch (75mm) thickness in vertical locations and up to 1½" inch thickness in overhead locations in a single application without the use of formwork. Thicker sections may be achieved by the use of formwork or the SikaRepair SHA with Latex R may be built up in layers. The final thickness is dependent on the material consistency and substrate profile. Deep spalls may sometimes be filled in a single application, depending on the actual configuration of the spall and the volume of exposed reinforcing steel. The material should not be applied at less than 3/8 inch (10mm).

1. Properties: The following results were obtained at 73°F and 50% relative humidity.

Test Method	Typical Result
Density (wet):	106 lbs./ft^3
Compressive Strength @ 28 days ASTM C-109:	5,000 psi
Slant Shear Bond Strength, ASTM C-882 modified 28 days:	1,800 psi
Flexural Strength, ASTM C-293, 28 days:	1,100 psi
Finishing time:	20-30 minutes
Pot Life:	Approx. 10-15 minutes

*All application and performance values are typical for the material but may vary because of variations in test methods, conditions, and configurations.

C. **Sikacrete 211 SCC Plus**:

Sikacrete 211 SCC Plus may be applied in sections up to 8 inches in thickness with the use of formwork. Thicker sections may be achieved by applying the material in layers. The material should not be applied at less than 1 inch.

1. Properties: The following results were obtained at 73°F and 50% relative humidity.

Test Method	Typical Result
Compressive Strength @ 28days ASTM C-109:	7,000 psi
Slant Shear Bond Strength, ASTM C-882 modified 28 days:	2,500 psi
Flexural Strength, ASTM C-78, 28 days:	1,000 psi
Splitting Tensile Strength, ASTM C-496:	1,000 psi
Application Time:	Approx. 60 minutes
Initial Spread:	Approx. 27-33 inches

*All application and performance values are typical for the material but may vary because of variations in test methods, conditions, and configurations.

D. **SikaQuick 1000**:

SikaQuick 1000 may be applied neat up to one inch thick. Applications greater than one inch and up to 6" thick requires the addition of 25 pounds of 3/8" clean, course, well graded, saturated surface dry, non reactive aggregate. Thicker sections may be achieved by applying the material in

layers. The material should not be applied at less than 1/4 inch.

1. Properties: The following results were obtained at 73°F and 50% relative humidity.

Test Method	Typical Result
Compressive Strength @ 28 days ASTM C-109:	5,500 psi
Slant Shear Bond Strength, ASTM C-882 modified 28 days:	2,700 psi
Flexural Strength, ASTM C-78, 28 days:	1,000 psi
Splitting Tensile Strength, ASTM C-496, 28 Days:	1,100 psi
Application time:	Approx. 20-30 minutes

*All application and performance values are typical for the material but may vary because of variations in test methods, conditions, and configurations.

PART 3 - EXECUTION

3.01 APPLICATION INSTRUCTIONS

A. Preparation:

1. All surfaces should be free from contamination such as paint, oil, grease, loose particles, decayed matter, moss, algae growth, laitance, and all traces of form release oils and curing compounds.

   a. Refer to Section 030100 – Concrete Surface Preparation for Coating.

2. Expose steel reinforcement fully to 100 percent of its circumference for all corroded steel in the repair area and remove all loose scale and corrosion deposits. The depth cut behind the reinforcement steel shall not be less than 3/4". Steel should be cleaned to a SSPC-SP10, Near White Metal Specification condition, paying particular attention to the back of exposed steel bars. Abrasive blasting shall be used for this process. If hand tool cleaning, use an SSPC-SP2 specification and if power tool cleaning, use an SSPC-SP3 specification. Where corrosion has occurred due to the presence of chlorides, the steel should be high-pressure washed with steam or clean water modified with an approved corrosion inhibitor immediately after abrasive blasting to remove corrosion products and residual chlorides from pits and imperfections within its surface. Reinforcement which is badly corroded or missing, may require replacement. Contractor is to notify the Architect in writing immediately if this condition occurs.

3. Concrete surface preparation will be performed in strict accordance with the manufacturer's instructions. The surface must be mechanically prepared to provide a fractured aggregate profile of +/- 1/16". Areas to be repaired must be clean, sound and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means approved by the Architect/Engineer. Continue removal of concrete at cracked areas down to solid substrate to a maximum 10 mil width of crack. Be sure the repair area is not less than 1/4" in depth, 1" depth minimum for the Sikacrete 211 SCC Plus. Concrete substrate must be structurally sound. Saw cut or cut back the extremities of the repair locations to a depth of at least 3/8" (10mm) to avoid feather edging and to provide a square edge. Roughen the saw cut edge of the repair to provide a rough, open textured surface.

4. Any remaining small cracks (10 mils max.) in the substrate in the area of the patching work must be treated with appropriate Sika filler product.

B. Priming of Reinforcing Steel with **Sika Armatec 110 Epocem**:

1. Mixing and application of the anti-corrosion coating for the reinforcement steel: Shake contents of components “A and B”. Empty the appropriate amount into a clean mixing container. Mix thoroughly for 30 seconds with a low speed drill and a jiffy mixing paddle. Slowly add the appropriate amount of component “C” while continuing to mix for three minutes until uniform with no lumps.

2. Apply one full coat of Sika Armatec 110 Epocem at 20 mils thick and allow it to dry approximately 2 hours before continuing. Apply a second coat at 20 mils thick.

C. Application of **SikaRepair SHA with Latex R** repair mortar:

1. Mixing and application of the vertical and overhead repair mortar: Mix a minimum of ¾ of a gallon of Latex R with one bag of SikaRepair SHA repair mortar in a clean dry mixing container, using a heavy duty, low speed drill (400-600 rpm), and appropriate mixing paddle, until uniform consistency, a maximum of three minutes. Do not exceed 1 gallon per bag.

2. The substrate should be saturated surface dry with no standing water.

3. Apply a scrub coat of the mixed material with a stiff bristle brush. While the scrub coat is still wet place the SikaRepair SHA repair mortar. For applications greater than 1 ½” in depth overhead, apply the material in lifts. Score the top surface of each lift to produce a roughened surface for the next lift. Allow the preceding lift to set prior to continuing. Repeat step 3.

4. Extend all existing control and expansion joints through any patch. Provide backer rod & sealant. Install new joints as recommended by the manufacturer and/or directed by the Architect.

D. Application of **Sikacrete 211 SCC Plus** form and pour material:

1. Place 5½ pints of clean water in a mixing container. Slowly add Sikacrete 211 SCC Plus while continuing to mix using a heavy duty, low speed drill (400-600 rpm), and a jiffy style mixing paddle, until uniform consistency, a maximum of three minutes. An additional ½ pint of water can be added if needed. Mix to a uniform consistency, maximum 3 minutes.

2. The substrate should be saturated surface dry with no standing water.

3. Pour the material into the forms and vibrate.

4. Extend all existing control and expansion joints through any patch. Provide backer rod & sealant. Install new joints as recommended by the manufacturer and/or directed by the Architect.

E. Application of **SikaQuick 1000** horizontal repair mortar:

1. Mix 4.5 pints of clean potable water with SikaQuick 1000 repair mortar in a clean dry mixing container, using a heavy duty, low speed drill (400-600 rpm), and a jiffy style mixing paddle until uniform consistency, a maximum of three minutes. Add up to another ½ pint of additional water to achieve the desired consistency.

2. For applications greater than one inch in depth add 25-30 pounds of clean, course, well graded, saturated surface dry, non reactive 3/8" pea gravel aggregate to one mixed unit of SikaQuick 1000.

3. Saturate the concrete with clean water. The surface should be saturated surface dry with no standing water.

4. Apply a slurry coat to the surface. While the slurry is still wet, apply the repair mortar.

5. Extend all existing control and expansion joints through any patch. Provide backer rod & sealant. Install new joints as recommended by the manufacturer and/or directed by the Architect.

F. All products mentioned in this section must be applied in strict accordance with the manufacturer's instructions. Carefully observe mixing, application and curing recommendations for each product.

G. Finishing:

1. SikaRepair SHA with Latex R and SikaQuick 1000 are finished by striking off with a straight edge and closing with a steel float. Wooden or plastic floats or damp sponges may be used to achieve the desired surface texture. The completed surfaces should not be overworked.

3.02 STORAGE AND CONDITIONS

A. Low Temperature Conditions:

1. In cold conditions down to 45°F (7°C), maintaining the Latex R Liquid at 65°F-75°F is advisable to accelerate strength development. Normal precautions for winter working with cementitious materials should then be adopted. The material should not be applied when the substrate and/or air temperature is 45°F (7°C) and falling. At 45°F (7°C) static temperature or at 45°F (7°C) and rising, the application may proceed. Do not apply if the temperature is expected to fall below 32°F within 72 hours of application.

B. High Temperature Conditions:

1. At ambient temperatures above 80°F (26°C), the materials should be conditioned to 65°F-75°F. Do not apply above 95°F.

3.03 CURING

A. All repair materials mentioned in this section are cement-based repair mortars. Under optimum conditions, curing may not be required. However, for purposes of bidding, these materials shall be cured immediately after finishing in accordance with good concrete practice (ACI308) to approach peak performance of the repair. Proper curing is of particular importance when ambient conditions (high temperatures, low humidity, moderate to high winds) may cause rapid moisture loss. The use of Sikagard Curing compound, sprayed onto the surface of the finished repairs in a continuous film, is recommended. Large areas should be cured as troweling progresses, 5 sq. ft. (0.47 sq. mtrs.) at a time without waiting for completion of the entire area. Other curing options include a fine mist of water; application of wet burlap; application of polyethylene sheeting taped down at the edges; or a combination of the above. In cold conditions, the finished repair must be protected from freezing. If doubts arise concerning the proper curing procedures, consult Sika Corporation's technical services department.

B. Clean Up:

1. Sika Armatec 110 Epocem, SikaRepair SHA, Sikacrete 211 SCC Plus, and SikaQuick 1000 should be removed from tools, equipment, and mixers with clean water immediately after use. Cured material can only be removed mechanically.

2. Clean hands and skin immediately with soap and water or industrial hand cleaner. Do not use solvents.

3.04 LIMITATIONS

A. All products mentioned in this section should not be used when the temperature is below 45°F (7°C) and falling. Neither should they be exposed to rain or moving water during application. Exposure to heavy rainfall prior to the final set may result in surface scour. If any doubts arise concerning temperature or substrate conditions, consult Sika Corporation's technical services department. Refer to the respective technical data sheets for the products mentioned in this section for further limitations.

3.05 PACKAGING AND YIELD

A. Estimating:

1. Supply:

a. Sika Armatec 110 Epocem: 1.65 gallon unit (22.7 fl. oz. A + 57.6 fl. oz. B + 4 bags of component C @ 5.5 lbs each.
b. Sika Repair SHA with Latex R: 50 lb. bag + 5 gallon pail
c. Sikacrete 211 SCC Plus: 65 lb. bag
d. SikaQuick 1000: 50 lb. bag

2. Coverage and Yield:

a. Sika Armatec 110 Epocem: 40 square feet per gallon
b. SikaRepair SHA with Latex R: .55 cubic feet per bag
c. Sikacrete 211 SCC Plus: 0.50 cubic feet per bag
d. SikaQuick 1000: .43 cubic feet per bag neat, .65 cubic feet per bag extended with 25 pounds of 3/8" pea gravel.

3. Notes: Due to waste factors and the variety and nature of possible substrates, practical coverage figures will vary.

3.06 STORAGE

A. Product has a shelf life of 12 months if kept in recommended storage conditions in the original, unopened containers.

B. Storage Conditions: Store in cool, dry conditions in the original unopened bags or cans. If stored at high temperatures and/or high humidity conditions, the shelf life may be reduced 4 to 6 months. Sika Latex R should be protected from freezing.

C. Health and Safety: Avoid breathing dust and avoid contact with skin. Rubber gloves and/or barrier creams, protective clothing, and goggles should be worn. Provide sufficient mechanical and/or local exhaust ventilation to maintain a low level of dust exposure. If ventilation is not provided, a NIOSH/MESA respirator should be worn.

D. Disposal: In case of spillage, absorb liquid and clean up powder by use of dustless method and

dispose of in accordance with applicable local, state, and federal regulations.

E. Special Precautions: Since emptied containers retain product residues (vapor, liquid, and/or solid), caution should still be exercised in their handling. Keep out of reach of children. For industrial use only. Not for internal consumption. Prior to use, consult MSDS and read proper handling instructions and warnings as noted on the product packaging.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.

B. Concrete paving and walks are specified in Division 2.

C. Section 03320: Concrete Slab on Grade.

D. Waterproofing is specified in Division 7.

1.2 DESCRIPTION OF WORK

A. This section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
2. ACI 301 "Specifications for Structural Concrete for Buildings."
3. ACI 303 "Guide to Cast-in-Place Architectural Concrete Practice."
4. ACI 304 "Guide for Measuring, Mixing, Transporting, and Placing Concrete"
5. ACI 305 "Hot-Weather Concreting."
6. ACI 306 "Cold-Weather Concreting."
7. ACI 311 "Guide for Concrete Inspection" and "Batch Plant Inspection and Field Testing of Ready-Mixed Concrete."
8. ACI 315 "Details and Detailing of Concrete Reinforcement."
9. ACI 318 "Building Code Requirements for Structural Concrete."
10. ACI 347 "Guide to Formwork for Concrete."
11. ACI SP-15 "Field Reference Manual." A copy of this publication shall be kept in the field office at all times during concrete construction.
12. AWS "Structural Welding Code - Reinforcing Steel."
13. CRSI "Manual of Standard Practice."
14. NYSDOT "Standard Specification for Construction and Materials."

B. To minimize irregularities in appearance or color, obtain cement, aggregates, admixtures, and water for each type of concrete construction exposed to view in completed project from same source for duration of that type of construction.

1.4 SPECIAL INSPECTIONS

A. Refer to Special Inspection Notes and Schedule of Special Inspections in Drawings.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

A. Preconstruction Testing: Contractor shall employ Testing Agency acceptable to Engineer and Architect to perform material evaluation tests and evaluate concrete mixes prior to submitting.

B. Submit concrete testing service qualifications demonstrating experience with similar projects.

C. Require concrete supplier to provide delivery tickets for each truckload of concrete. Tickets shall be presented to and reviewed by Contractor and Special Inspector or Testing Agency prior to discharging concrete into structure.

1. Tickets shall contain project identification name, name of Contractor, name of concrete supplier, location of batch plant, date and time of concrete batching, truck number, delivery ticket number, concrete type and class, concrete mix number, design compressive strength at 28 days, concrete mix proportions and materials, and amount of total mix design water that can be added at site prior to discharging into structure if total mix design water was not used when batched. See Part 3 of this section for maximum water amount that can be added at site.

D. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture and the Special Inspector will visit construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify RDPs 48 hours before anticipated time of completion of reinforcement for a given section of work so they may determine if site observations are required. If site observations are required, do not place concrete until RDPs have had opportunity to observe reinforcement.

1.6 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Show bar schedules, bar spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required for openings through concrete.
   a. Show elevations of reinforcement for all members at minimum 1/4 inch = 1 foot scale.
   b. Show locations of construction and control joints.
   c. Reference Contract Drawing number and addendum number in each shop drawing.
   d. Do not place reinforcing information from more than one design discipline (structural, civil, landscape) in each drawing.
2. Submit formwork, shoring, and reshoring drawings and details for structural concrete slab and beams for information only. Design and construction of formwork, shoring, and reshoring remains sole responsibility of Contractor. Formwork drawings shall be prepared and stamped by New York State Professional Engineer.

B. Mix Designs: Submit proposed mix designs for concrete 15 days minimum before start of concreting. Submittal must be in the Concrete Mix Design Submittal Form at end of this section for each class of concrete.

C. Submit data and installation instructions for proprietary material.

D. Submit to Special Inspector and Engineer material certificates certifying each material complies with specifications.

E. Submit chloride ion content of proposed admixtures prior to submitting mix design.

1.8 PRODUCT HANDLING

A. Store materials so as to preserve their quality and fitness for work. Store reinforcement and formwork in manner to prevent damage and accumulation of dirt.

1.9 WORKMANSHIP

A. Contractor shall be responsible for correction of concrete work not conforming to specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by Architect.

B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed/plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown in drawings. Plywood materials shall be one of the following:

1. Overlaid plywood complying with U.S. Product Standards PS-1 "A-C or B-B High Density Overlaid (HDO) Concrete Form," Class 1, exterior grade or better.
2. Plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class 1, exterior grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds with maximum VOC of 450 g/l that will not bond with, stain, or adversely affect concrete surfaces or impair subsequent treatments of concrete surfaces requiring bond or adhesion or impede wetting of surfaces to be cured with water or curing compound.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off, metal form ties, designed to prevent form deflection and spalling concrete upon removal. Provide units that will leave no metal closer than 1 inch to exposed surface.

1. Provide ties that will leave holes no larger than 1-inch diameter in concrete surface when removed.
2. Unexposed concrete: “Type A-3 Snap Tie Standard” by Dayton Superior or accepted equivalent.
3. Exposed concrete: “Type A-3 Snap Tie Heavy” by Dayton Superior or accepted equivalent.
4. Internal wood spreaders are prohibited.

2.2 REINFORCING MATERIALS

A. Deformed bars: ASTM A 615, Grade 60. Deformed bars to be welded, ASTM A 706.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Use wire bar-type or all plastic-type supports complying with CRSI specifications. Use chairs with sand plates or horizontal runners where base material will not support chair legs.

1. Concrete bricks may be used to support footing reinforcing. Stagger brick locations.
   a. Do not use clay bricks.
   b. Do not use bricks to support epoxy-coated or galvanized reinforcing.
2. Supports for epoxy-coated reinforcing shall be either wire bar-type coated with epoxy, plastic, or vinyl compatible with concrete for a minimum distance of 2 inches from the point of contact with reinforcing or all plastic-type.
3. Supports for galvanized reinforcing shall be either galvanized wire bar-type or all-plastic type.
4. Finish (epoxy-coated or galvanized) for supports formed from reinforcing bars shall match the finish of the supported reinforcing.
5. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are plastic-protected (CRSI, Class 1) or stainless-steel

protected (CRSI, Class 2).

D. Minimum 16-gauge annealed tie wire, ASTM A 82.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Aggregates: NYSDOT-approved, Section 703-02 (normal weight), one source and as specified.

1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps, or other deleterious substances.
2. Coarse Aggregate: Clean, uncoated, processed aggregate free from clay, mud, loam, or foreign matter.
   a. For footings, foundation walls, piers, grade beams, basement walls, retaining walls, and interior walls, blend of NYSDOT size 1 and 2 (25 percent size 1 and 75 percent size 2) or gradation conforming to ASTM C 33, size 467:

Sieve Size	Percent Passing
2 inch	100
11/2 inch	95 to 100
3/4 inch	35 to 70
3/8 inch	10 to 30
No. 4	0 to 5

   b. For other applications, blend of NYSDOT size 1 and 2 (40 percent size 1 and 60 percent size 2) or gradation conforming to ASTM C 33, size 57:

Sieve Size	Percent Passing
1 1/2 inch	100
1 inch	95 to 100
1/2 inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5

   c. No size requirement for stair-pan fill and lean concrete.

C. Water: Clean, fresh, drinkable.

D. Air Entraining: ASTM C 260.

E. Water-Reducing Admixture: "Eucon WR-75" or "WR-89" by Euclid Chemical Co.; "Pozzolith 220N" by Master Builders; or "Plastocrete 161" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type A, and not contain more chloride ions than in municipal drinking water.

F. Water-Reducing Retarder: "Eucon Retarder-75" by Euclid Chemical Co; "Pozzolith 100XR" by Master Builders; or "Plastiment" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type D, and not contain more chloride ions than in municipal drinking water.

G. Noncorrosive, Nonchloride Accelerator: ASTM C 494, Type E, and not contain more chloride ions than in municipal drinking water.

H. Fly Ash: ASTM C 618, Type F, with a loss on ignition of less than 4 percent.

I. Ground-Granulated, Blast-Furnace Slag: ASTM C 989, Grade 120.

J. High-Range, Water-Reducing Admixture (Superplasticizer): "Eucon 37" by Euclid Chemical Co. or "Sikament" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type F

or G, and not contain more chloride ions than in municipal drinking water.

K. Nonchloride Waterproofing Admixture: “KIM - Krystol Internal Membrane” by Kryton International Inc.; “Xypex Admix C-500, C-1000, or C-2000” by Xypex Chemical Corporation; or “Anti-Hydro – NC or NCR Waterproof Concrete” by Anti-Hydro International, Inc.

L. Prohibited Admixtures: Calcium chloride, thiocyanates, and admixtures containing more than 0.05 percent water-soluble chloride ions by weight of cement or more than 0.3 percent thiocyanates by weight of cement shall not be permitted.

2.4 RELATED MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces a square yard and complying with AASHTO M 182, Class 2.

B. Curing-Sheet Materials: One of the following moisture-retaining covers, complying with ASTM C 171: waterproof paper, polyethylene film, or polyethylene-coated burlap.

C. Clear Curing and Sealing Compound (VOC compliant): ASTM C 309 with minimum 18 percent solids content. Use "Diamond Clear VOX" by Euclid Chemical Co. or accepted equivalent.

D. Horizontal Joint Sealants: “Sonolastic SL2” by Sonneborn Building Products; “Sikaflex-2c SL” by Sika Corp.; “Eucolastic 2 SL” by Euclid Chemical Co.; or accepted equivalent.

E. Vertical Joint Sealants: “Eucolastic 2” by Euclid Chemical Co.; “Sonolastic NP2” by Sonneborn Building Products; “Sikaflex-2c NS” by Sika Corporation; “Brutem 92” by Master Builders, Inc.; or accepted equivalent.

F. Joint Filler: ASTM D 1751, ½-inch-thick, premolded, expansion joint filler strips.

G. Backer Rod: “Sonofoam” polyethylene closed-cell foam by Sonneborn Building Products or accepted equivalent.

H. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217-inch-thick (26-gauge) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

L. Sleeves:

1. Schedule 40, PVC for 12-inch diameter or smaller.
2. ASTM A 53, hot-dip galvanized for larger than 12-inch diameter.

M. Anchor Rods and Leveling Plates: Furnished in Section 051200 and installed under this section.

N. Non-shrink Grout: Corp of Engineers CRD-C 621. “Conspec 100” by Conspec Manufacturing Co.; “NS Grout” by Euclid Chemical Co.; “SikaGrout 212” by Sika Corp.; “Masterflow 928” or “Set Grout” by Master Builders, Inc.; “Sonogrout” by Sonneborn Building Products; or accepted equivalent.

O. Bonding Agent: “Strongbond” by Conspec Manufacturing Co.; “SBR Latex” by Euclid Chemical Co.; “Everbond” by L&M Construction Chemicals, Inc.; “Acryl-Set” by Master Builders, Inc.; “SikaLatex” by Sika Corp.; “Sonocrete” by Sonneborn Building Products; or accepted equivalent.

P. Chemical Adhesive for Doweled Reinforcement:

1. Anchors to solid concrete, grouted CMU, solid brick, or stone:

a. Anchors for use when base material temperature is 0°F or greater: “HIT-Ice” by Hilti; “Epcon A7” by ITW Ramset/Red Head; “AC 100 Plus” by Powers Fasteners; “AT Acrylic-Tie” by Simpson/Strong-Tie; or accepted equivalent.

b. Anchors for use when base material temperature is 40°F or greater; “HIT HY 150” or “HIT HY 150 MAX” by Hilti; “Epcon C6” by ITW Ramset/Red Head; “T308 Plus” by Powers Fasteners; “ET Epoxy-Tie” by Simpson/Strong-Tie; or accepted equivalent.

2.5 PROPORTIONING AND MIX DESIGN

A. Prepare design mixes for concrete. Use independent testing facility acceptable to Architect for preparing and reporting proposed mix designs.

B. Where concrete production facility can establish uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed specified design strength by requirements of ACI 318, Section 5.3.2.1 or ACI 301, Section 3.9.

C. When a concrete production facility does not have field-test records for calculation of standard deviation, the required average strength shall be determined in accordance with ACI 318, Section 5.3.2.2.

D. Pozzolans:

1. Pozzolans may be substituted for cement in normal-weight concrete, including fly ash, at a maximum rate of 20 percent by weight or ground-granulated, blast-furnace slag at a maximum rate of 35 percent by weight.
2. Submittals shall include actual mix design, including percentage of pozzolans and test results showing mix meets specified 7-day compressive strength where indicated, 28-day compressive strength, and air content.
3. Protect and heat concrete containing pozzolans during cold-weather conditions. Maintain protection and heat until 70 percent of specified design strength is achieved.

E. Quantity of coarse aggregate in pounds must be in the range of 1.25 to 1.5 times quantity of fine aggregate in pounds.

F. Concrete Quality:

Location	**Required 7-day Compressive Strength psi**	**Required 28-day Compressive Strength psi**	**Maximum Water/Cement Ratio**	**Percent Entrained Air**
Footings, interior stair pans, misc. concrete.	NA	3,000	0.55	4.5*
Retaining walls, basement walls, interior walls, foundation walls, piers, grade beams.	3,000	4,000	0.5	4.5*

Lean concrete	NA	1,500	0.65	4.5*

* Plus or minus 1.5 percent.

G. Slump:

1. Footings, foundation walls, piers, grade beams, misc. concrete: 3 inches to 5 inches.
2. Retaining walls, basement walls, interior walls: 4 inches maximum.
3. Concrete containing high-range, water-reducing admixture (superplasticizer) shall have a maximum slump of 9 inches unless otherwise accepted by Engineer. Concrete shall arrive at job site at a slump of 2 to 3 inches, shall be verified, then high-range, water-reducing admixture added to increase slump as required for placement and workability.
4. Type G superplasticizer may be added at plant if adequate quality control measures are implemented to verify slump and admixture quantities at plant before addition of superplasticizer. Concrete shall maintain required slump during transportation and placement. Quality control testing at plant shall be performed by an independent testing laboratory employed by Contractor and acceptable to Architect.
5. Ready-Mix Concrete: ASTM C 94.
6. Provide batch ticket for each batch discharged and used in work indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

2.6 REINFORCING FABRICATION

A. Fabricate bars to required lengths, shapes, and bends. Do not rebend or straighten reinforcement in manner that could weaken material.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Examine conditions under which concrete shall be placed. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 FORMWORK INSTALLATION

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, sleeves, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent concrete mortar leakage.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, etc., for easy removal.

D. Erect forms in logical sequence to allow placement and inspection of reinforcement and other

embedded items.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for concrete placement. Securely brace temporary openings, and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

F. Provide cleanout panels at bottoms of deep wall and column forms.

G. Chamfer exposed corners and edges as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

H. Fit corners and joints with gaskets or tape to prevent leakage.

I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

J. Sleeves: Provide sleeves in concrete formwork for plumbing, electrical, and mechanical penetrations. Coordinate size and location of sleeves with Contractors and mechanical, electrical, and plumbing drawings.

1. Accurately place and secure in forms.
2. Coordinate sleeve locations with reinforcing bars.
3. Penetrations shall not occur through footings, piers, columns, beams, joists, grade beams, or supported slabs unless shown in structural drawings.

K. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before placing concrete as required to prevent mortar leaks and maintain proper alignment.

L. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing materials are not acceptable. Apply new form-coating compound material. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets.

M. Clean and coat forms before erection. Do not coat forms in place.

N. Place concrete plugs in exposed holes left by form-tie cones.

3.3 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring and reshoring in multistory construction and as herein specified.

B. Provide thermometers adjacent to formwork to record curing temperatures.

C. Design formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.

D. Formwork for beams, slabs, and other parts that support weight of concrete shall remain in place at least 7 days and until concrete has reached 75 percent of the 28-day design strength as indicated by field-cured cylinders. No additional loads of any sort shall be permitted on the structure until it has reached its 28-day design strength or has been properly reshored. Forms shall be removed at risk of the Contractor, and no pointing or patching shall be done until Engineer has observed the concrete and permitted such work.

E. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

F. Reshore removal shall be based on compressive test results of field-cured cylinders and shall not occur until concrete has reached the 28-day design strength.

G. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations and provided curing and protection operations are maintained.

H. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.4 REINFORCEMENT PLACEMENT

A. Clean reinforcement of loose rust, mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

B. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, hangers, or concrete brick as required.

1. Wire-tie intersections as required to prevent displacement of reinforcement.
2. Do not wet set reinforcing bars. Wet setting is not permitted.

C. Place reinforcement to obtain at least minimum concrete coverages for protection of bars. Minimum required concrete cover is noted in drawings.

D. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Use of nails in forms and use of clay brick to support reinforcement shall be prohibited.

F. Lap bar splices as indicated. Stagger splices in adjacent bars. Wire-tie splices.

G. Splice reinforcement at joints of low stress.

H. At points where bars lap-splice, including distribution steel, provide wire-tied minimum lap of 30-bar diameters unless otherwise required.

I. Coordinate placement of reinforcement with openings, including sleeves and other embedded items. Where one or more bars are interrupted, provide additional reinforcement at openings. Additional reinforcement is noted in drawings.

J. Place concrete in manner to ensure alignment of elements remains unchanged.

K. Comply with manufacturer-recommended procedures for installing and anchoring of doweled reinforcement using chemical adhesives, including drilling and cleaning of holes and mixing and applying of adhesives.

3.5 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items including anchor rods, leveling plates, embedded plates, and angles required for other work attached to

or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Do not wet set embedded items. Accurately position, support, and secure embedded items against displacing by formwork, construction, or concrete placement operations.

1. Provide No. 3 rebar ties at top and bottom of anchor rods to maintain position or other accepted method.

C. Anchor rods and embedded structural supports incorrectly located or damaged after installation shall be field modified, including repair or replacement, by Contractor.

1. Notify Engineer of defective work. Submit proposed field modifications to Engineer for review and acceptance prior to making corrections.
2. Proposed field modifications shall include design details and calculations, signed and sealed by a licensed Professional Engineer hired by Contractor.
3. Field modifications shall be tested in accordance with Section 051200. Perform pull-out tests and other appropriate tests on each repair.
4. Cost of field modifications shall be borne entirely by Contractor at no additional cost to Owner. Contractor shall reimburse Owner for cost of additional testing required.

3.6 INSTALLATION OF NON-STRUCTURAL EMBEDDED ITEMS

A. General: Notify other trades to permit installation of their work, including reglets, conduit, and piping and to coordinate requirements of this section. Cooperate with other trades in setting work as required.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings on outer face of exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. ACI 318, Article 6.3, and guidelines listed below apply to conduit and piping.

1. Do not embed aluminum items unless coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
2. Other than those passing through concrete elements, do not embed items that are larger than one-third of thickness of concrete element in which they are embedded.
3. Unless shown otherwise in structural drawings, install items as follows:
    a. Space at least 12 inches apart and not less than three diameters or widths on center.
    b. Place so they do not cross over each other within concrete elements.
    c. Place so they do not displace reinforcing bars from their proper location.
    d. Provide at least 3/4-inch concrete cover between items and reinforcing bars or concrete surfaces not exposed to weather or in contact with ground. Do not lay items on reinforcing bars. Provide at least 1½-inches concrete cover between items and concrete surfaces exposed to weather or earth.
    e. Securely position items by wire tying to support chairs or supports formed from reinforcing bars.
    f. Install sleeves at penetrations for nonstructural items passing through concrete elements.

3.7 PREPARATION OF FORM SURFACES

A. General: Coat contact surfaces of forms with an accepted form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or to come in contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a nonstaining, rust-preventive material. Rust-stained steel formwork is not acceptable.

3.8 CONSTRUCTION JOINTS

A. Locate and install construction joints not shown in drawings so as not to impair strength and appearance of structure as acceptable to Architect.

1. Provide keyways at least 1 1/2 inches deep in construction joints in walls. Roughen joints between reinforced concrete walls and footings.
2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
3. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

3.9 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.

1. Notify other trades to permit installation of their work. Cooperate with other trades in setting work as required.

B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete" and as specified.

C. A maximum of 2 1/2 gallons for each cubic yard of total mix design water can be added in field. Water must be added prior to discharging and testing concrete. At no time shall total water exceed amount listed in accepted mix design.

D. Deposit concrete continuously or in layers of such thickness that no concrete shall be placed on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within section. Provide construction joints if section cannot be placed continuously.

E. Deposit concrete as nearly as practicable to its final location to avoid segregation caused by rehandling or flowing.

F. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in manner to avoid inclined construction joints.

G. Keep excavations free of water. Do not deposit concrete in water, mud, snow, or on frozen ground.

H. Maximum drop of concrete shall not exceed 5 feet. Use hopper and trunk for greater drops.

I. Maintain reinforcing in proper position during concrete placement.

J. Contractor shall be responsible for controlling the proper placing of embedded pipe, conduit, and other embedded items. See section “Installation of Non-Structural Embedded Items” for additional information.

K. Pumping concrete is permitted only if mix designs specifically prepared and used previously for pumping are submitted. Pump line shall have 5-inch-minimum inside diameter and be used with 5-inch pumps.

3.10 CONSOLIDATION

A. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

B. Do not use vibrators to transport concrete inside formwork.

C. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Vibrators shall penetrate placed layer of concrete at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.

D. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Do not allow vibrator to come in contact with form.

3.11 SURFACE FINISHES

A. Rough-Form Finish: Provide as-cast, rough-form finish to formed concrete surfaces that shall be concealed in finished work or by other construction. Standard rough-form finish is concrete surface having texture imparted by form-facing material used, with tie holes and other defective areas repaired and patched, and fins or other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Form Finish: Provide smooth-form finish for formed concrete surfaces that shall be exposed to view or covered with material applied directly to concrete such as waterproofing, dampproofing, veneer plaster, painting, or other similar systems. Produce smooth-form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.12 CURING AND PROTECTION

A. Protect concrete from premature drying, excessive hot or cold temperature, and mechanical injury in accordance with provisions of ACI 301, Section 5.3.6.

B. Curing Methods: Perform concrete curing by wet-curing or moisture-retaining cover curing or combinations thereof as specified.

C. Provide wet-curing by following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges with 4-inch lap over adjacent absorptive covers.

D. Provide moisture-cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair holes or tears during curing period

using cover material and waterproof tape.

E. Curing Vertical-Formed Surfaces:

1. Keep forms in place for minimum of 7 days, 14 days in cold weather or until concrete has achieved 70 percent of its design strength.
2. If forms are removed before minimum time period, alternate methods of curing, wet-curing, moisture-retaining cover curing, or liquid-membrane curing, are required.
   a. Contractor shall submit procedures to Architect for review.
   b. Forms shall remain in place for a minimum of 24 hours when alternating methods of curing are used. For placement during cold weather, the minimum time to form removal shall be extended based on expected weather conditions and Contractor's submitted procedures.

F. Cure concrete placed under cold-weather conditions completely covering exposed surface of concrete with moisture-retaining cover completely sealed around edges. Cure concrete 14 days minimum with concrete temperature at or above 40 degrees F or 7 days minimum with concrete temperature at or above 70 degrees F.

G. During hot weather after concrete has hardened, loosen form ties, keeping forms in place, and apply water to inside face of form to keep concrete continuously moist.

3.13 COLD-WEATHER CONCRETING

A. Place concrete in accordance with ACI 306.

B. For cold-weather concreting (defined as a period when for more than 3 successive days the mean daily temperature is below 40 degrees F), maintain concrete temperature in accordance with Table 3.1, and maintain concrete protection in accordance with Table 5.3 in "Cold-Weather Concreting" reported by ACI Committee 306.

C. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain concrete mixture temperature recommended in Table 3.1 of ACI 306.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

3.14 HOT-WEATHER CONCRETING

A. Place concrete in accordance with ACI 305.

B. Cool ingredients before mixing to maintain concrete temperature below 85 degrees F at time of placement.

C. Mixing water may be chilled or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water.

D. Cover reinforcing steel with water-soaked burlap if temperature of reinforcing steel exceeds ambient air temperature.

E. Wet forms thoroughly before placing concrete.

F. Fog-spray forms and reinforcing steel just before placing concrete.

G. Use water-reducing, retarding admixture when required by high temperature, low humidity, or other adverse placing conditions when acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after form removal when acceptable to Architect.

1. Cut out honeycombs, rock pockets, voids over 1/2 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but not to a depth of less than 1 inch. Make edges of cuts perpendicular to concrete surface. Thoroughly clean, dampen with water, and brush-coat area to be patched with bonding agent. Place patching mortar before bonding compound has dried.
2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so patching mortar will match surrounding color when dry. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. These include surface defects such as color, texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form-tie holes, and fill with dry-pack mortar or precast-cement cone plugs secured in place with bonding agent.

1. Where possible, repair concealed formed surfaces containing defects affecting concrete durability. If defects cannot be repaired, remove and replace concrete.

C. Repair of Unformed Surfaces: Test unformed surfaces for smoothness, and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using template having required slope.

1. Repair finished unformed surfaces containing defects affecting concrete durability. These include surface defects such as crazing, cracks, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

D. Repair methods not specified above may be used subject to acceptance of Architect.

3.16 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades unless otherwise shown or directed after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown in drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.17 TOLERANCES

A. Footings:

1. Variation of dimensions in plan: plus 2 inches or minus 1/2 inch.

2. Variation of center from specified center in plan: 2 percent of width in direction of variation, plus or minus 2-inches maximum variation.
3. Variation of bearing surface from specified elevation: plus or minus 1/2 inch, unless otherwise specified.

B. Piers, Columns, Walls, and Grade Beams:

1. Variation in cross-sectional dimensions of piers, columns, grade beams, and in thickness of walls: plus or minus 1/4 inch.
2. Variation in plan from specified location in plan: plus or minus 1/2 inch for any member in any location.
3. Deviation in plan from straight lines parallel to specified linear building lines: 1/4 inch for adjacent members less than 20 feet apart or any wall length less than 20 feet; 1/2 inch for adjacent members 20 feet or more apart or any wall length of 20 feet and greater.
4. Deviation from plumb: 1/4 inch for any 10 feet of height; 1 inch maximum for entire height.
5. Variation in elevation from specified elevation: plus or minus 1/2 inch for any member in any location.
6. Deviation in elevation from lines parallel to specified grade lines: 1/4 inch for adjacent members less than 20 feet apart or any wall length less than 20 feet; 1/2 inch for adjacent members 20 feet or more apart or any wall length of 20 feet and greater.

C. Anchor Rods and Sleeves:

1. Variation from specified location in plan: plus or minus 1/4 inch.
2. Variation from specified elevation: plus or minus 1/2 inch.

D. Embedded Items (plates, angles, etc.) other than anchor rods and sleeves:

1. Variation from specified location in plan: plus or minus 1/4 inch.
2. Variation from specified elevation: plus or minus 1/4 inch.

END OF SECTION 033000

DIVISION 03 – CONCRETE

SECTION 035416 – SELF LEVELING CEMENTITIOUS UNDERLAYMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Related Sections include the following:

1. Section 013563 – LEED Requirements
2. Section 017419 – Construction Waste Management
3. Section 028218 – Removal of Asbestos Contaminated Substrate Material
4. Section 033000 – Cast-in-Place Concrete
5. Section 090561.13 – Moisture Vapor Emission Control
6. Section 093013 – Ceramic Tile
7. Section 096519 – Resilient Flooring
8. Various other Division 09 Flooring Sections.

1.02 SCOPE

A. The work under this section of the specifications shall consist of furnishing all labor, materials, equipment, and appliances necessary or required to furnish and install all work of this section as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Provide a self-leveling cementitious underlayment in accordance with the Contract Documents.

2. This system consists of the use of a primer and a mix of special cements and binders which, when mixed with water, becomes a highly liquid cement compound that seeks its own level and produces a smooth and flat surface. Finished surface shall be true to plane in accordance with ACI 117, Standard Specifications for Tolerances for Concrete Construction & Materials, or as directed by the floor finish manufacturer.

3. This Section includes ARDEX K 15® a self-leveling underlayment that consists of a blend of Portland cement and other hydraulic cements and polymers that is used to level and smooth interior concrete, terrazzo, well-bonded ceramic & quarry tile, epoxy coating systems, wood, metal and properly prepared, non-water-soluble adhesive residue on concrete prior to the installation of finish flooring on all grade levels.

   a. ARDEX K 15® Premium Self-Leveling Underlayment

   b. ARDEX P 51™ Primer

   c. ARDEX P 82™ Ultra Prime

   d. ARDEX EP 2000™ Substrate Preparation Epoxy Primer

   e. ARDEX E 25™ Resilient Emulsion

   f. ARDEX Feather Finish® Self-Drying, Cement-Based Finishing Underlayment

B. For this project, it is the expressed intent that all self-leveling products are to be provided in

accordance with the Specifications by the General Contractor at all necessary and appropriate thicknesses at all locations requiring self-leveling product application due to new or existing slabs/subfloors not meeting required finish flooring product tolerances or infill of recessed slabs/subfloors. Refer to the specifications and manufacturers requirements for additional tolerance requirements specific to each type of finish flooring.

1.03 REFERENCES

A. ASTM C109M, Compressive Strength Air-Cure Only
B. ASTM C348, Flexural Strength of Hydraulic-Cement Mortars
C. ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes
D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
E. ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

1.04 QUALITY ASSURANCE

A. Self-leveling underlayment concrete shall be " ARDEX K 15®" as manufactured by Ardex, Inc., 400 Ardex Park Dr, Aliquippa PA 15001, www.ardexamericas.com; or Architect approved equal.

   1. Underlayment shall be able to be installed from 1/8” over the highest point in the space and up to 1 1/2” in one pour and up to 5” with the addition of aggregate. It may also be feathered to match existing elevations.

   2. Underlayment shall be walkable after 2-3 hours and allow floor covering to be installed after 16 hours at 70°F.

   3. Underlayment compressive strength shall be 5500 psi after 28 days per ASTM C109/mod (air cure only)

   4. After proper substrate preparation, underlayment shall be suitable for use over the following substrates.

      a. New construction: Un-level concrete, rough concrete, rained-on concrete, frozen concrete, unfinished concrete, rough-screeded concrete, wooden or metal subfloors.

      b. Rehabilitation projects: Existing concrete, wood, metal, terrazzo, quarry tile, ceramic tile, and over cutback adhesive residue.

B. Installation of the ARDEX product must be completed by a factory-trained applicator, such as an ARDEX LevelMaster® Elite, Choice Contractor or INSTALL Substrate Prep Certified Installer, using mixing equipment and tools approved by the manufacturer. Contact ARDEX Engineered Cements (724) 203-5000 for a list of recommended installers.

C. Product must have a hydraulic cement-based inorganic binder content as the primary binder which includes portland cement per ASTM C150: Standard Specification for Portland Cement and other specialty hydraulic cements. Gypsum-based products are not acceptable.

D. Manufacturer Experience: Provide products of this section by companies which have successfully specialized in production of this type of work for not less than 10 years. Contact Manufacturer Representative prior to installation.

1.05 SUBMISSIONS

A. General: Comply with provisions of Section 013300 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Safety Data Sheets.

1. Complete materials list of all items proposed to be furnished and installed under this Section.

2. Manufacturer's specifications and other data required demonstrating compliance with specified requirements.

3. Manufacturer's certification that the product specified is suitable for the intended use when installed according to the parameters described in the manufacturer's printed literature and installation instructions.

4. Installer Qualifications: Manufacturer's written approval that installer is trained and qualified to perform work of this type.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store products in a dry area with temperature maintained between 50° and 85°F and Protect from direct sunlight.

C. Handle products in accordance with manufacturer's printed recommendations.

1.07 PROJECT CONDITIONS

A. Do not install material below 50°F surface and air temperatures. These temperatures must also be maintained during and for 48 hours after the installation of products included in this section. Install quickly if the substrate is warm and follow warm weather instructions available from the ARDEX Technical Service Department.

1.08 WARRANTY

A. ARDEX K 15® installed as part of a floor system, shall be installed in conjunction with the recommended ARDEX Tile & Stone Installation Materials or WW HENRY Flooring Adhesive, as appropriate, to provide the ARDEX SystemOne comprehensive warranty, depending on the system installed.

PART 2 – PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Hydraulic Cement-Based Self-Leveling Underlayment:

1. The Portland cement-based self-leveling, cementitious underlayment or patching material shall be: ARDEX K 15® self-leveling underlayment concrete (for all standard self-leveling); or Architect approved equal.

a. Primer:

1) Standard Absorbent Concrete: ARDEX P 51™ Primer.
2) Extremely Absorbent Concrete: May require two applications of ARDEX P 51™ to minimize the potential for pinholes forming in the ARDEX K 15.
3) Wood: ARDEX P 82™ Ultra Prime.

4) Metal: ARDEX EP 2000™ Substrate Preparation Epoxy Primer.
5) Other Non-Porous Substrates (burnished concrete, terrazzo, well-bonded ceramic, quarry and porcelain tiles, epoxy coating systems and non-water-soluble adhesive residue on concrete and concrete treated with silicate compounds): ARDEX P 82™ Ultra Prime.

b. Performance and Physical Properties: Meet or exceed the following values for material cured at 73° F+/-3°F and 50% +/-5% relative humidity:

1) Application: Barrel Mix or Pump
2) Flowing Time: Approximately 10 minutes
3) Initial Set, ASTM C191: Approximately 30 minutes
4) Final Set, ASTM C191: Approximately 90 minutes
5) Compressive Strength: 5,500 psi at 28 days, ASTM C109M
6) Flexural Strength: 1,200 psi at 28 days, ASTM C348
7) Flammability, ASTM E84-81a:

Flame Spread	-0-
Fuel Contribution	-0-
Smoke Development	-0-

8) VOC: 0
9) Coverage: Approx. 30 sq.ft. per bag at 1/4".

2. Primer for non-porous subfloors, cut-back and non-water soluble adhesive residues, and metal and wooden subfloors shall be ARDEX P 82™ Ultra Prime.

3. The additive to be mixed with ARDEX K 15® when used over cut-back adhesive, metal, or wooden subfloors shall be ARDEX E 25™ Resilient Emulsion.

4. Aggregate shall be well-graded, washed pea gravel (1/8" to 1/4" or larger) for use when underlayment is installed over 1 1/2" thick. (Max. installation is 5”)

5. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

6. Portland cement-based trowel-grade underlayment (for patch & skim coating) shall be:

a. ARDEX SD-P® Instant Patch Self-Drying, Fast-Setting Concrete Underlayment Patch (for repairing substrates and ramping).

b. ARDEX Feather Finish® Self-Drying, Cement-Based Finishing

B. Moisture Vapor Suppression (For use where the level of moisture emissions from the concrete slab exceed the maximum permitted by the manufacturer of the finished flooring):

1. Moisture Control System shall be ARDEX MC™ Rapid one-coat moisture control system for use over new or existing concrete. Use of a moisture control system shall be field determined based upon relative humidity measurements within the concrete in accordance with ASTM F2170 or surface of the concrete in accordance with ASTM F2420. Labor and material costs for the installation of the moisture control system are excluded from the contractors Base Bid and shall be applied via agreed upon Change Order or Allowance Authorization in accordance with the General Conditions of Contract.

2.02 MIX DESIGNS

A. ARDEX K 15® Self-Leveling Underlayment Concrete (standard underlayment):

1. Standard mixing ratio: ARDEX K 15® shall be mixed in 2-bag batches at one time. Mix each

bag of ARDEX K 15® (55 lb.) with 7 quarts of water. Product shall be mixed in T-10 mixing drum using a T-1 mixing paddle and a 1/2" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX K 15® bag label.

2. Resilient mix for applications over cutback and non-water soluble adhesive residues, wood, and metal: Use 6 qt. of water and 2 qt. of ARDEX E 25™ Resilient Emulsion for each bag of ARDEX K 15®.

3. Aggregate mix: For areas to be installed over 1 1/2" thick and up to 5”, aggregate may be added to reduce material costs. Mix ARDEX K 15® with water first, then add from 1/3 up to 1 part by volume of aggregate (1/8" to 1/4" or larger). Do not use sand.

4. For pump installations, ARDEX K 15® shall be mixed using the Ardex Levelcraft Automatic Mixing Pump. Start the pump at 210 gallons of water per hour, and then adjust to the minimum water reading that still allows self-leveling properties. DO NOT OVERWATER. Check the consistency of the product on the floor to ensure a uniform distribution of the sand aggregate at both the top surface and bottom of the pour. If settling is occurring, reduce the water amount and recheck. If settling is occurring, reduce the water amount and recheck. Conditions during the installation, such as variations in water, powder, substrate, and ambient temperature, require that the water setting be monitored and adjusted carefully to avoid overwatering.

B. ARDEX SD-P® - Instant Patch Self-Drying, Fast-Setting Concrete Underlayment Patch (for repairing substrates and ramping):

1. Mix 1 bag of Ardex SD-P (40 lbs.) with 4 quarts of water. Product can be mixed in a clean 5-gallon pail using a mixing paddle and a ½” heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written installation instructions per Ardex SD-P bag label.

C. ARDEX Feather Finish® - Self-Drying, Cement-Based Finishing Underlayment (for flash patching & skim coating):

1. The recommended mixing ratio is 2 parts powder to 1 part water by volume. Mix the ARDEX Feather Finish® powder with water to the desired trowelable consistency using a margin trowel or an approved paddle and drill.

PART 3 - EXECUTION

3.01 GENERAL

A. In addition to the general procedures described herein, refer to manufacturer's current published product literature for complete installation details for the underlayment system being installed.

3.02 SUBSTRATE PREPARATION

A. General: Prepare substrate in accordance with manufacturer’s instructions.

B. Concrete:

1. Prior to proceeding please refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before priming. Mechanically clean if necessary using shot blasting or other. **Acid etching and the use of sweeping compounds and solvents are not acceptable.**

2. Substrates shall be inspected in accordance with ASTM F2170 and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering. For areas where moisture vapor emissions exceed the required limits refer to Section 090561.13, Moisture Vapor Emission Control and install the appropriate ARDEX Moisture Control System.

C. Wooden subfloors:

1. The wood subfloor either must be solid hardwood flooring; a minimum of ¾" (19 mm) tongue-and-groove, APA-rated Type 1, exterior exposure plywood; or an approved OSB equivalent. The wood subfloor must be constructed according to prevailing building codes and must be solid and securely fixed to provide a rigid base free of undue flex. Any boards exhibiting movement must be refastened to create a sound, solid subfloor.

2. The wood must be clean and free of all foreign matter. If necessary, sand down to bare wood. Vacuum to remove all dust. Do not use solvent, strippers or cleaners. Open joints should be filled with ARDEX FEATHER FINISH®. It is the responsibility of the installation contractor to ensure that the wood subfloor is thoroughly clean and properly anchored prior to the installation of any ARDEX material.

D. Metal subfloors:

1. Metal subfloors must be rigid, well supported, properly anchored and free of undue flex and vibration. They must also be clean and free of all rust, corrosion and foreign matter. Where required, a corrosive resistant coating should then be applied, and be allowed to dry before priming.

2. Non-lead metal substrates must be mechanically cleaned and profiled to create a bonding surface. Please note that care must be taken when mechanically preparing thin metal foils so that the metal foil is not compromised. Use an #80 or #100 grit sanding screen to mechanically profile the metal surface. A hand or floor sander may be used. After sanding, thoroughly deep vacuum to remove all loose material, and then wipe the metal using a clean, white cloth dampened with 91% isopropyl alcohol. Repeat wiping using a new cloth on each pass until the degree of discoloration on the cloth remains consistent on subsequent passes (typically, approx. 5 – 7 passes). Lightly shot blasting also is suitable. From this point until the metal has been primed, disposable shoe covers should be worn by anyone traversing the surface of the prepared metal. Allow 15 – 20 minutes for residual alcohol to evaporate before proceeding. Contact the Technical Service Department for guidelines on preparing lead substrates.

E. Adhesive residues on concrete must first be tested to make certain they are not water-soluble. Water-soluble adhesives must be completely mechanically removed down to clean concrete. Non-water-soluble adhesives should be prepared to a thin, well-bonded residue using the wet- scraping technique as recommended by the Resilient Floor Covering Institute (www.rfci.com). The prepared residue should appear as nothing more than a transparent stain on the concrete after scraping.

F. Non-porous subfloors such as ceramic, porcelain and quarry tile, burnished concrete, epoxy coating systems as well as terrazzo should be clean and free of all waxes, sealers, dust, dirt, debris and any other contaminant that may act as a bond breaker. If necessary, clean by mechanical methods such as shot blasting.

G. All subfloors, regardless of material, must be solid, thoroughly cleaned, and properly primed. Gypsum, latex patches, asphalt, coal tar and lightweight insulating concrete are not suitable substrates to receive cementitious underlayment.

1. Cut-back and other non-water soluble adhesive residues must be wet-scraped to a thin, solid, well bonded layer.

2. Non-porous surfaces such as ceramic tile, quarry tile, terrazzo etc., should be clean and free of wax and sealers. If necessary, have the surface professionally cleaned.

3. All cracks in the subfloor shall be repaired to minimize telegraphing through the underlayment.

4. Prior to installation, substrates shall be inspected and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering. If moisture vapor emissions exceed the flooring manufacturer's recommendations, installation of an ARDEX MC™ Moisture Control System (ARDEX MC RAPID, MC PLUS or MC Ultra) will be required. For complete installation instructions, please refer to the appropriate ARDEX MC Moisture Control Technical Brochure.

H. ARDEX MC™ Moisture Control System shall be installed in accordance with manufacturers written technical instructions.

3.03 CRACK AND JOINT PREPARATION

A. Moving Joints and Moving Cracks – honor all expansion, isolation joints and moving cracks up through the underlayment. A flexible sealing compound such as ARDEX ARDISEAL™ Rapid Plus Semi-Rigid Joint Sealant may be installed.

B. Saw Cuts, Dormant Control Joints and Dormant Cracks – fill all dormant control joints and dormant cracks with ARDEX ARDIFIX™ Low Viscosity Rigid Polyurethane Crack & Joint Repair or ARDEX FEATHER FINISH® Self-Drying, Cement-Based Finish Underlayment as recommended by the manufacturer.

C. When using an Ardex MC Moisture Control System, installation shall be in accordance with manufacturers written technical instructions for the treatment of saw cuts, control joints and dormant cracks.

3.04 APPLICATION OF ARDEX K-15:

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.

C. Priming:

1. Note: When using ARDEX P 51, It is critical to ensure that the ARDEX P 51 is dry prior to proceeding with the next installation step. To determine if the ARDEX P 51 is dry after a minimum of 30 minutes (max. 24 hours), pour water onto the surface of the primer in several areas and rub it with your finger. If the water remains clear, the primer is dry. If the water turns cloudy or milky, additional drying time is needed.

2. Primer for standard absorbent concrete subfloors: Dilute ARDEX P 51 1:1 with water and apply evenly with a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (min. 30 minutes, max. 24 hours). Underlayment shall not be applied until the primer is dry.

3. Primer for extremely absorbent concrete subfloors: Make an initial application of ARDEX P 51 mixed with 3 parts water using a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry thoroughly (1 to 3 hours) before proceeding with the standard application of primer as described above for standard absorbent concrete.

4. Primer for non-porous subfloors such as burnished concrete, terrazzo, well-bonded ceramic, porcelain and quarry tile, epoxy coating systems, wooden subfloors and non-water soluble adhesive residues over concrete: Prime with ARDEX P 82 Ultra Prime. Follow the mixing instructions on the container and apply with a short-nap or sponge paint roller, leaving a thin coat of primer no heavier than a coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tacky film (minimum 3 hours, maximum 24 hours). Underlayment shall not be installed until primer is dry. Note: If a suitable acrylic curing compound has been used on the concrete, test the surface for porosity. If the concrete is porous, prime with ARDEX P 51. If it is non-porous, prime with ARDEX P 82. For wood substrates, once the primer is applied, install 3.4 galvanized, expanded diamond metal lath mesh, stapling approximately every 6 inches (15.2 cm). Do not walk on wet primer.

5. Primer for metal substrates: Prime the prepared subfloor with ARDEX EP 2000 and immediately broadcast fine sand to refusal into the fresh epoxy. After a 16-hour cure remove all excess sand. Remove all excess sand prior to proceeding:

    a. Do not sweep. Using a rubber squeegee, consolidate excess sand into piles.
    b. Shovel the piles of sand into barrels.
    c. Vacuum remaining sand using a heavy-duty, bucket-style (Shop-Vac®-style) vacuum and HEPA dust extraction vacuum system.

D. Mixing: Comply with manufacturer's printed instructions and the following.

1. Add 7 quarts (6.6 L) of clean potable water per 55 lb. (25 kg) bag. For applications over wood and metal, the addition of ARDEX E 25™ Resilient Emulsion is required to increase the resiliency of the ARDEX K 15. In these cases, mix 2 quarts (1.9 L) of ARDEX E 25 with 6 quarts (5.68 L) of water for each bag of ARDEX K 15.

2. Mix using a ½" (12 mm) heavy-duty drill (min. 650 rpm) with an ARDEX T-1 mixing paddle. Do not overwater. When mixing sanded materials, ARDEX recommends using the ARDEX DUSTFREE™ or a standard "gutter hook" vacuum attachment in combination with a wet/dry (Shop-Vac® style) vacuum and HEPA dust extraction vacuum system. Additionally, each bag should be handled with care and emptied slowly to avoid creating a plume of dust. Contact the ARDEX Technical Service Department for more details on ARDEX products and air quality management.

3. Aggregate mix: For areas to be installed over 1 ½" (4 cm) thick, aggregate may be added to reduce material costs. Mix ARDEX K 15® with water first, then add 1 part aggregate by volume of washed, well-graded 1/8" to 3/8" (3 to 9.5 mm) pea gravel. The aggregate size must not exceed 1/3 the depth of the pour. Do not use sand. Note: The addition of aggregate will diminish the workability of the product and may make it necessary to install a finish coat to obtain a smooth surface. Allow the initial application to dry for 12 to 16 hours, and then prime this layer with ARDEX P 51 mixed 1: 1 with water. Allow the primer to dry (min. 30 minutes, max. 24 hours) before installing the neat coat of ARDEX K 15.

4. For pump installations, ARDEX K 15® shall be mixed using the ARDEX ARDIFLO™ Automatic Mixing Pumps. Contact the ARDEX Technical Service Department (888) 512-7339 for complete pump operation instructions.

E. Application: Comply with manufacturer's printed instructions and the following.

1. Installations over metal and other non-porous substrates should be limited to a thickness of ½" (12.7 mm) unless otherwise approved by the ARDEX Technical Services Department. For all other substrates, ARDEX K 15® must be installed at a minimum thickness of 1/8" (3 mm) over the highest point in the floor, which typically results in an average thickness of ¼" (6 mm) or more over the entire floor. ARDEX K 15® can be installed up to 1 ½" (4 cm) over large areas

neat, and up to 5” (12.7 cm) with the addition of proper aggregate. ARDEX K 15® can also be featheredged to match existing elevations. If a true featheredge is needed, ARDEX recommends using ARDEX FEATHER FINISH® for transitions.

2. Pour or pump the liquid ARDEX K 15® and spread into place with the ARDEX T-4 Spreader. Immediately use the ARDEX T-5 Smoother to smooth the surface. Wear non- metallic cleats to avoid leaving marks in the liquid ARDEX K 15®.

3. Wood subfloors require the use of the mesh-reinforced ARDEX K 15® + E 25™ Resilient Emulsion Underlayment System. After priming, install 3.4 galvanized diamond metal lath by stapling to the wooden subfloor approximately every 6 inches to center.

4. Metal subfloors require the use ARDEX K 15® + E 25™ Resilient Emulsion Underlayment System.

F. Curing:

1. ARDEX K 15® can be walked on in 2-3 hours. Moisture-insensitive tiles such as ceramic, quarry and porcelain can be installed after 6 hours. All other finish floor coverings can be installed after 16 hours at 70°F (21°C). For resinous systems such as epoxy and polyurethane floors please contact the ARDEX Technical Services Department.

3.05 APPLICATION OF ARDEX SD-P

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.

C. Priming:

1. Porous concrete:

a. While no primer is required to obtain a solid bond when installing ARDEX SD-P over concrete, ARDEX P 51 can be used to prime a properly prepared concrete substrate prior to installing ARDEX SD-P. The use of ARDEX P 51 will improve the workability of the product, prevent it from drying out too fast, and help ensure that any residual dust on the surface of the concrete will be bound up so that it will not interfere with the bond.

b. For this application, mix ARDEX P 51 with an equal part of water, and prime the properly prepared concrete surface using a soft bristle push broom. Once the primer has dried (min. 30 minutes, max. 24 hours). It is critical to ensure that the ARDEX P 51 is dry prior to proceeding with the next installation step. To determine if the ARDEX P 51 is dry after a minimum of 30 minutes (max. 24 hours), pour water onto the surface of the primer in several areas and rub it with your finger. If the water remains clear, the primer is dry. If the water turns cloudy or milky, additional drying time is needed.

2. Burnished concrete, epoxy coating systems, terrazzo, ceramic, quarry and porcelain tiles, concrete treated with silicate compounds shall be primed with ARDEX P 82. Do not leave any bare spots. Brush off puddles and excess primer. Allow primer to dry to a thin, slightly tacky film (min. 3 hours, max. 24 hours).

D. Mixing: Comply with manufacturer's printed instructions and the following.

1. Add 4 quarts (3.8 L) of clean potable water per 40-pound (18 kg) bag.

2. Mix using a ½" (12 mm, 650 rpm) low speed heavy-duty mixing drill with an ARDEX T-2 ring mixing paddle. Do not overwater.

3. When mixing sanded materials, ARDEX recommends using the ARDEX DUSTFREE™ or a standard "gutter hook" vacuum attachment in combination with a wet/dry (Shop-Vac® style) vacuum and HEPA dust extraction vacuum system. Additionally, each bag should be handled with care and emptied slowly to avoid creating a plume of dust. Contact the ARDEX Technical Service Department for more details on ARDEX products and air quality management.

E. Application: Comply with manufacturer's printed instructions and the following.

1. ARDEX SD-P can be installed from a true featheredge up to 1" (25.4 mm) over large areas neat and up to 3" (7.6 cm) with the addition of proper aggregate. ARDEX SD-P can also be featheredged to match existing elevations. There is no minimum thickness requirement for this product. Use the least amount possible to attain the desired smoothness. The thickness of the application should be calculated based on the surface profile of the substrate and the specified tolerances of the floor covering.

2. For areas with a thickness greater than 1" (25.4 mm), mix ARDEX SD-P with washed and well-graded 1/8" – ¼" (3 – 6 mm) pea gravel. Mix the ARDEX SD-P with water first, and then add part aggregate by volume, mixing until the aggregate is completely coated. Do not use sand. If the aggregate is wet, reduce the amount of water to avoid overwatering.

3. For applications of ARDEX SD-P over non-porous substrates, the maximum thickness is ¼" (6 mm).

4. Apply the ARDEX SD-P to the substrate with a wood or magnesium float to obtain a solid mechanical bond. Allow the material to take set (approx. 30 minutes) then finish the surface using a steel trowel.

F. Curing:

1. As soon as the ARDEX SD-P can be worked on without damaging the surface (approx. 90 minutes), standard floor coverings such as ceramic tile, VCT, sheet vinyl and carpeting can be installed. If installing wood flooring, or, if high-performance adhesives will be used, such as epoxies or urethanes, ARDEX SD-P must first cure for 16 hours.

3.06 APPLICATION OF ARDEX FEATHER FINISH

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.

C. Priming:

1. Gypsum: Make an initial application of ARDEX P 51 diluted with 3 parts water using a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry thoroughly (1 to 3 hours) before proceeding with the second application of ARDEX P 51 diluted 1:1 with water. Allow thorough drying to a clear, thin film (min. 3 hours, max. 24 hours).

D. Mixing: Comply with manufacturer's printed instructions and the following.

1. Add 2 1/2 quarts (2.4 L) of clean potable water per 10-pound (4.5 kg) bag.

2. Mix using a ½" (12 mm, 650 rpm) low speed heavy-duty mixing drill with an ARDEX T-2 ring mixing paddle. Do not overwater.

E. Application: Comply with manufacturer's printed instructions and the following.

1. ARDEX FEATHER FINISH can be installed from a true featheredge up to ½" (12.7 mm) over large areas. It can also be installed up to any thickness in small, well-defined areas.

2. Apply the ARDEX FEATHER FINISH to the substrate with the flat side of a trowel to obtain a solid mechanical bond before applying the desired thickness.

F. Curing:

1. As soon as the ARDEX FEATHER FINISH can be worked on without damaging the surface (15-20 minutes), standard floor coverings such as VCT, sheet vinyl and carpeting can be installed. If installing wood flooring, or, if high-performance adhesives will be used, such as epoxies or urethanes, ARDEX FEATHER FINISH must first cure for 16 hours (70°F).

3.07 PREPARATION FOR FLOORING INSTALLATION

A. Underlayment can accept finish floor covering materials, to include Carpet, after 16 hours at 70°F and 50% relative humidity.

B. The surface of the underlayment shall be checked to ensure that it meets the flooring manufacturer's specifications for flatness before beginning the flooring installation. Areas out of tolerance shall be repaired using the appropriate Ardex underlayment (described herein based upon tolerance discrepancy) as required at the contractors expense.

C. Due to the wide range of adhesives that are used to install floor coverings, some adhesives may dry more quickly over underlayments than over other substrates. If this condition occurs, priming the surface of the underlayment with ARDEX P-51 Primer diluted 1:3 with water will even out the drying of the adhesive. Allow the primer to dry 1-3 hours before proceeding with the adhesive installation.

3.08 FIELD QUALITY CONTROL

A. Where specified, field sampling of the ARDEX underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

3.09 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

END OF SECTION

DIVISION 04 – MASONRY

SECTION 040100 – MASONRY RESTORATION AND CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Provide all labor, materials, and equipment necessary and required to repair and/or replace all existing cracked, chipped, spalled, and loose masonry and tuckpoint existing masonry joints as indicated on the drawings and specified herein.

2. Provide all labor, materials, and equipment necessary and required to clean existing masonry surfaces as indicated on the drawings and specified herein.

1.02 RELATED SECTIONS

A. Section 040120 – Masonry Surface Preparation for Coating
B. Section 042000 – Unit Masonry
C. Section 079200 – Joint Sealants

1.03 REFERENCES

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 2002.

B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2002.

C. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

D. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

1.04 SUBMITTALS

A. Comply with the requirements of Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Brick or other masonry units: Submit manufacturer’s product data, include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is indicated.

2. Masonry cleaning products: Submit manufacturer's product literature and application instructions demonstrating compliance with specified requirements.

3. Premixed pigmented pointing mortar: Submit manufacturer's product literature and application instructions demonstrating compliance with specified requirements.

4. Components of site-mixed pointing mortar (where mortar type or building age dictate): Submit manufacturer's product literature demonstrating compliance with specified requirements.

5. Flashings, backer rod, sealant, etc: Submit manufacturer's product literature and application instructions demonstrating compliance with specified requirements.

C. Samples:

1. Masonry units: Submit 3 samples of each type of replacement masonry unit.

a. Unit masonry samples for each type of exposed masonry unit required; include in each set the full range of exposed color and texture to be expected in completed work.

b. Include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is indicated.

2. Colored masonry mortar samples for each color required showing the full range of color which can be expected in the finished work. Label samples to indicate type and amount of colorant used.

3. Site-mixed pointing mortars must be prepared on-site.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Masonry Cleaning:

a. Manufacturer: Regularly engaged in manufacturer of masonry cleaning products with at least 5 completed applications of materials to be provided in this project.

b. Applicator: Experienced with use of masonry cleaning products. Provide documentation of such experience when requested by the Architect.

c. For buildings designated Historic by the NYOPRHP, or those eligible for listing on the National Register of Historic Places, the Contractor is obligated to follow the National Park Service Preservation Brief No. 1, Assessing Cleaning and Water-Repellant Treatments for Historic Masonry Buildings.
https://www.nps.gov/orgs/1739/upload/preservation-brief-01-cleaning-masonry.pdf

d. Low-pressure water washing (below 250 psi) and gentle non-ionic detergents are to be used.

2. Tuckpointing:

a. Tuckpointing work is only to be performed by a qualified and experienced tuckpointing craftsman. Field mock-ups required below are to be prepared by those who will perform the masonry work.

b. Contractor is obligated to follow the National Park Service Preservation Brief No. 2, Repointing Mortar Joints in Historic Masonry Buildings.
https://www.nps.gov/orgs/1739/upload/preservation-brief-02-repointing.pdf

B. Field Samples/Mock-ups:

1. Masonry Repointing: In area selected by Architect, repoint a nine (9) square foot area of brick masonry in accordance with specified requirements for Architect's approval. Obtain Architect's approval of sample area before proceeding with masonry repointing.

a. One field sample/mock-up shall be provided for each of three mortar samples, either pre-mixed, site-mixed, or both, selected by the Architect for a final decision by the Architect and/or Owner. Mock-ups shall be repeated until a satisfactory match is obtained.

b. Prior to pointing, sample area shall first be prepared for review of joint cutting depth and extent. Architect shall be notified when this preparation step is ready for review so it can be approved and process can advance to pointing approvals.

2. Masonry Replacement: In area selected by Architect, replace a nine (9) square foot area of brick masonry in accordance with specified requirements for Architect's approval. Obtain Architect's approval of sample area before proceeding with masonry repointing.

a. One field sample/mock-up shall be provided for each of three brick samples selected by the Architect for a final decision by the Architect and/or Owner. Mock-ups shall be repeated until a satisfactory match is obtained.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:

1. Protect masonry restoration materials during storage against wetting by rain, snow, or ground water, and against soilage or intermixture with other materials.

a. Mortar and grout materials: Store in a dry location or in waterproof containers, tightly closed and away from open flames. Protect liquid components from freezing and comply with manufacturer's recommendations for minimum/maximum temperature requirements.

2. Store all materials in single place approved by Architect, kept clean and neat. Correct damage to storage area and surroundings.

1.07 EXAMINATION OF THE SITE

A. The Contractor shall visit and thoroughly familiarize himself with the site and with the scope of work to be done. He is advised to carefully examine any and all existing conditions which would affect the cost of the required work under the contract and to judge for himself conditions which will exist when he carries out his contract, as he will be entitled to no extra compensation for any work required by field conditions.

B. When the Contractor submits his proposal, it will be interpreted to mean that he has examined the site, fully understands the existing proposed conditions, and he has made due allowances for them in his proposal.

1.08 SITE CONDITIONS

A. Do not lay masonry or stonework, repoint, caulk, wash down or wet surfaces when temperature may drop below 40º F within 24 hours, Follow cold weather procedures as set out in ANSI A41.1 when temperatures may drop below 40º F.

B. Maintain materials and surrounding air temperature to minimum 40º F and maximum 90º F prior to, during and 48 hours after completion of masonry work.

C. Cold Weather Requirements: Comply with recommendations of IMIAWC (CW).

D. Hot Weather Requirements: Comply with IMIAWC Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

E. Mortar:

1. Heat mixing water when air temperature is below 40º F and heat aggregates when temperature is below 32º F to assure mortar temperatures between 40º and 120º F until used.

2. Produce subsequent mortar batches within +/- 10º of first batch.

3. Do not heat water or sand above 120º.

1.09 PROTECTION

A. Protect windows, doorways, trim and other surfaces from damage and immediately remove stains, efflorescence or other unsightly excess resulting from the scope of work.

B. Protect roof membranes and flashings from damage. Lay ½" min. plywood on roof surfaces over full extent of work area and traffic route.

C. Seal existing wall louvers with plastic during the work to reduce infiltration of dust into the building throughout the duration of the scope of work.

1.10 SCAFFOLDING

D. Furnish, install, and maintain safe, OSHA approved scaffolding and/or other staging equipment throughout the duration of the entire project. Safe and compliant work process is the full responsibility of the contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mortar Materials:

1. Portland cement: ASTM C150, Type 1.

a. Type III may be used to reduce protection requirements for laying masonry in cold weather, if approved in advance by Architect.
b. Provide white or gray cement as required to produce required mortar color.

2. Lime: Hydrated, complying with ASTM C207, Type S.

3. Sand: Clean, white washed with 100 percent passing No. 16 sieve and complying with ASTM C144.

4. Mortar color compounds: Inorganic used in proportions recommended by manufacturer, but not exceeding 15 percent of cement weight. Do not exceed 3 percent of cement weight for carbon black.

5. Fine aggregate (for grout): No. 1 sand complying with ASTM C404.

B. Brick Units: Face brick units matching color, texture, and size of existing face brick, and complying with ASTM C216, Type FBX.

C. Acidic cleaner for areas scheduled to receive substantial quantities of brick replacement (effectively "new" brick areas): Manufacturer's standard strength general purpose cleaner designed for new masonry surfaces of type indicated; composed of blended organic and inorganic acids combined

with special wetting systems and inhibitors; expressly approved for intended use by manufacturer of masonry units being cleaned.

1. "Sure Klean" No. 600 Detergent; ProSoCo, Inc.

2. Protect areas of existing brick that are not being replaced that may be above, below, and adjacent to the replaced brick from the acidic cleaner.

D. For areas of heavy atmospheric staining, paint oxidation, carbon buildup and other atmospheric pollutants, use:

1. Sure Klean Heavy Duty Restoration Cleaner NE.

2.02 ACCESSORIES

A. Through-Wall Flashing:

1. Copper fabric flashing, 7 oz., asphalt-free (red):

a. York Multi-Flash 500 series York Manufacturing Inc., Sanford, Maine.

2. Provide pre-fabricated stainless steel inside corners, outside corners, and end dams.

3. Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1" composite material bar or a 1” 26-gauge stainless steel termination bar with sealant lip.

4. Drip Edge: Stainless-steel with 30-degree 3/8” bent outer edge, hemmed. 3” by 8’.

B. Copper Counter Flashing:

1. 16 oz. soft copper broken to match profile indicated on drawings.

C. Backer Rod:

1. Closed cell foam of diameter required by condition.

D. Caulk:

1. Single component gun-grade urethane sealant.

2.03 MIXES

A. Mortar and Grout - Brick Masonry:

1. Mortar proportions - Type N (by volume) ASTM C270: 1 part Portland cement; 1 part hydrated lime; and 6 parts sand measured in damp, loose condition and constituting not less than 2-1/4-inch not more than 3 times total volume of cement and lime (1:1:4½-6).

2. Grout proportions - Fine Grout (by volume ASTM C476: 1 part Portland cement; 0-1/10 part lime; and same equal to 2-1/4 to 3 times total volume of cement and lime.

3. Mixing: Thoroughly premix Portland cement, hydrated lime, and aggregates; then add water and mix for minimum 5 minutes in mechanical batch mixer.

a. For mortar, add as much water as required for workability. Retemper mortar by adding

water and remixing as required for workability, but only within first 2½ hours of pot life.

b. Do not use mortar or grout which has begun to set or which is more than 2-1/2 hours old since initial pre-hydration. Do not add water to retemper old mortar after this point.

B. Do not add air entraining agents or other admixtures to mortar or grout materials specified.

C. Color compounds are to be added in accordance with manufacturer's recommendations.

1. Pre-mixed, pre-bagged colored mortars may be acceptable when submitted for review and approved. Acceptable manufacturers are:

a. Norval
b. Sandell

2. Mortar shall be high in lime content, and softer than existing brick and no harder than existing mortar.

PART 3 - EXECUTION

3.01 REPOINTING

A. Joint Preparation:

1. The contractor shall protect all existing window and door openings and adjacent materials and surfaces from damage during the pointing process. Any damage incurred shall be corrected by the contractor at no additional cost to the owner.

2. With a toothing chisel or pointers grinder, carefully remove all existing deteriorated all joints found to be loose, weak, broken, or structurally defective until firm mortar is reached, but not less than 3/4". Remove joints with the following conditions for spot pointing:

a. Loose or crumbling mortar.
b. Soft and sandy mortar which can be removed without excessive pressure by hand scraping with blunt end of pointing tool.
c. Hollow spaces concealed, or partially concealed by shell of mortar.
d. Joints containing cracks between mortar and masonry where a 34 gauge W & M wire can be inserted 1/2" or more.
e. Where mortar has eroded from the face of the masonry.
f. Where hairline cracks are apparent in the mortar.
g. Where the bond between the masonry and mortar is broken.
h. Where there is plant growth in or around the mortar joint.

3. When documents indicate 100% pointing or "full" pointing of a building face or similar area, the following additional preparation is required:

a. All mortar joints which are sound and do not require repointing due to deterioration shall be partially removed to a uniform depth, minimum ¾" and repointed to match newly pointed joints.
b. Joints which have been previously pointed shall also be partially removed and repointed to match new joints.
c. Remove all mortar joints deteriorated or sound for a project where 100% pointing is indicated.

4. Prior to applying new mortar, clean-out all loose material, debris, and dust.

5. Wet joints before applying new mortar. Allow water to soak into joints, but joints should not be visibly wet with free standing water during repointing.

    a. Architect reserves the right to inspect any and all joints prepared by contractor before proceeding with repointing.

B. Joint Filling:

1. The tuckpointing mortar should be prehydrated to a damp workable consistency which will retain its shape when formed into a ball. Note: Allow mortar to stand in this dampened condition for 1 to 1 1/2 hours.

2. Fill mortar joints in layers not over 1/4" thick, with each layer applied with pressure as soon as previous layer has partially dried. Leave surface of each layer rough; do not tool smooth until final layer is applied.

3. Compress final packing as much as possible to completely fill joint. Compact joints solidly before final tooling.

C. Tooling and Curing:

1. When final mortar layer is thumbprint hard, tool joint to match adjacent existing masonry, or of 100% pointing is required, then tool joints concave. Take care to not spread mortar over edges of brick onto exposed surfaces. Do not feather edge mortar.

2. Following tooling, remove excess mortar from edge of joint.

3. Allow joints to cure for at least 5 days, maintaining in damp condition using water hoses and fine spray mist.

4. The final appearance of the façade shall be uniform in terms of mortar coloration, tooling, and size of joints. Joints shall be tooled to match existing, or where the entire wall is being redone, new joints shall be tooled concave.

5. After completion of pointing work, all loose mortar and mortar staining shall be cleaned from surface of masonry.

3.02 BRICK REMOVAL AND RECONSTRUCTION

A. Removal and replacement (this work is generally to be completed prior to overall pointing):

1. Where the existing bricks units are defective, or are damaged as part of the restoration, cut out the old mortar surrounding the affected units and remove the brick. Chisel out all old mortar and remove all dust and debris, being careful not to allow debris to fall into the cavity. Dampen surrounding brick surfaces and place new unit of similar size and coloration into opening.

B. Defects warranting replacement include, but are not limited to, spalled units, units with subflouresence, previously sandblasted units, units where fired face has weathered off, cracked, and broken units.

1. Support and protect masonry to remain surrounding removal area. Clean edges of masonry to remain by removing mortar, dust, or loose debris.

C. Reconstruction:

1. Install new through-wall flashing where indicated on Drawings or where required by

performance of the work in accordance with manufacturer's installation recommendations. Provide full head joint weep holes above flashings at 24” o.c. staggered.

2. Fit replacement masonry units into bonding and coursing pattern of existing masonry. Lay units with completely filled bed, head, and collar joints. Butter ends sufficiently to fill head joints and shove into place. Maintain joint width to match existing masonry and tool to match existing masonry, or concave if a full area project.

3. Use motor-driven saw/grinder designed to cut masonry with clean, sharp, unchipped edges where cutting is required.

D. Sawcutting of new control/expansion joints:

1. At locations indicated on the Drawings, sawcut a ½” wide joint the full height of the wall area and fully through the depth of the brick or veneer wythe. Provide backer rod and caulking full height.

E. Tooling and Curing:

1. Joint filling, tooling, and curing shall be the same as described under 3.01.C.

3.03 FLASHING OF MASONRY WORK

A. General: Provide concealed flashing in masonry work at or above shelf angles, lintels, ledges, and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and cut back flush after mortar has cured.

1. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work where inner wythes can be disturbed by the work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills turn up ends not less than 2" to form a pan.

2. Where new flashings are installed in a solid wall construction (often pre 1950s), terminate to inner course with a continuous termination bar sealed at the top edge in best condition to prevent passage of moisture beyond line of flashing.

3. Where new flashings are installed in a “Larsen System” type wall (often 1950s to early 1960s consisting of CMU backup with brick headers and staggered flashings), attempt to lift higher layer of existing flashing and install new flashing below, positively lapping and sealing existing flashing to new. If this is not possible, then provide continuous termination bar and sealant above to existing backup condition.

4. Where new flashings are installed in a cavity-type construction (often mid-1960s to present), provide continuous termination bar to backup masonry and seal top edge.

5. Interlock end joints of flashings not less than 1-1/2" and seal lap with compatible sealant or flashing cement.

6. Install flashing to comply with manufacturer's instructions.

7. Provide full open head joint weep holes in the head joints of the first course of masonry

immediately above concealed flashings. Space weep holes at 24" o.c. unless otherwise indicated.

8. Install reglets and nailers for counter flashing and other related work where shown to be built into masonry work, or install counterflashing below through wall flashing to maintain positive drainage flow.

3.04 REMOVAL AND REPLACEMENT OF CONTROL/EXPANSION JOINT CAULKING AND CAULKING OF NEW JOINTS

A. Where control and/or expansion joints exist within the areas of masonry work that are being reconstructed, remove existing joint filler material and provide new foam backer rod and caulking for the full extent of the joint. This shall be done in coordination with pointing but before cleaning unless cleaners are not compatible with the caulking proposed. If incompatible, then perform caulking after cleaning.

B. Where new control and/or expansion joints are indicated, coordinate with the work of 3.01 and 3.02.

3.05 POST-CONSTRUCTION DETERGENT CLEANING

A. Final Cleaning: After mortar is thoroughly sets and cured, clean masonry with detergent as follows:

1. Cleaners shall be applied and removed in accordance with manufacturer’s instructions.

2. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

3. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

4. Protect non-masonry surfaces (adjacent windows, doors, panel systems, etc.) from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

5. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

6. Use bucket and brush hand cleaning method described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale, except use masonry cleaner where indicated on the drawings.

7. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins. Restoration cleaners indicated herein are not suitable for use on concrete masonry.

8. Clean limestone units to comply with recommendations in "ILI Handbook" published by Indiana Limestone Institute of America.

B. Where detergent is determined to be too harsh or otherwise unsuitable for cleaning, then clean according to 3.06 below.

3.06 POST-CONSTRUCTION MECHANICAL AND WATER CLEANING

A. Remove excess mortar, sealant, or other material from face of masonry as repointing or masonry rebuilding progresses.

B. Allow completed restoration to cure for approximately 30 days, then thoroughly clean exposed masonry surfaces with stiff nylon bristle brushes and clean water under normal pressure.

C. Do not use metal scrapers or metal brushes.

1. Do not use acid or alkali cleaning agents.

3.07 PROTECTION

A. Provide protection of work and maintain protective conditions in a manner acceptable to the Owner, which ensures the work will be without damage or deterioration to the time of substantial completion.

END OF SECTION

DIVISION 04 – MASONRY

SECTION 040120 – MASONRY SURFACE PREPARATION FOR COATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work under this Section of the Specifications shall consist of furnishing all labor, materials, equipment, and appliances necessary or required to furnish and install all work of this Section and other related work in connection with cleaning and preparation of masonry surfaces to provide a clean, contamination-free surface suitable for the application of permanent coatings.

1. The Contractor shall remove all water, dirt, paint, grease, oils, loose materials, and previous coatings from the surfaces to be coated to the satisfaction of the coating manufacturer and the Architect.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.03 RELATED SECTIONS

A. Section 030130.11 – Cementitious Concrete Finish Coating
B. Section 030130.12 – Elastomeric Concrete Finish Coating
C. Section 030130.13 – Acrylic Concrete Finish Coating
D. Section 040100 – Masonry Restoration and Cleaning
E. Section 042000 – Unit Masonry

1.04 APPLICABLE STANDARDS

A. ASTM Standards:

D4261 Standard practice for surface cleaning concrete masonry units for coating.

D4285 Test method for indicating oil or water in compressed air.

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 01300 – Submittal Procedures and as modified below.

B. The Contractor shall submit the cleaning procedure, in accordance with this specification, outlining methods, equipment and materials to be used for cleaning of masonry to the Architect for approval prior to the commencement of work.

C. Submit manufacturer’s data for products including application instructions.

D. Contractor shall perform full cleaning procedure on a selected sample area to verify acceptability prior to proceeding with full scope of cleaning.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Steam Cleaning: Remove heavy deposits of grease and oil as well as other water-soluble surface contaminants and emulsifiable materials with low-pressure steam in accordance with ASTM D4258.

B. Detergent water cleaning may be performed in lieu of steam cleaning provided the contractor demonstrates that the proposed product(s) and procedure yields similar results to steam cleaning that are acceptable to the Architect.

1. Detergent water cleaning shall consist of scraping of heavy deposits of dirt, grease or oil and cleaning the surface with a stiff-bristled brush using an aqueous solution of detergent or non-solvent emulsifier. Immediately after treatment, before the surface dries, residues of the cleaning agent shall be removed by thoroughly flushing the surface with clean potable water.

2. Prior to detergent water washing, provisions must be made for the collection and removal of waste wash water and contaminates generated by this cleaning method.

3. The use of acids for cleaning or preparing surfaces is not permitted.

C. Correct fins and protruding irregularities by mechanical means.

3.02 ABRASIVE BLAST CLEANING:

A. Abrasive blast cleaning is required when the Surface Preparation above is alone insufficient to provide a clean, acceptable surface for coating or if abrasive blasting, sand blasting, or shot blasting is specifically required by the Drawings or other specification sections. In any case, all costs associated with abrasive blast cleaning shall be borne by the contractor and included in the bid.

B. Clean masonry surfaces in accordance with Surface Preparation section above.

C. Erect temporary containment barriers suitable to the project to capture all spent blast media and particulate matter.

1. The Contractor shall be fully responsible for any and all contamination to adjacent properties and shall clean and make all necessary repairs to same at no expense to the Owner.

D. Masonry surface may be wet or dry as appropriate to the type of equipment to be used.

E. Apparatus: Typical methods are wet or dry open blast cleaning with nozzles and self-contained recirculating blast cleaning apparatus.

1. The compressor shall supply a minimum pressure, in the hose, of 620 KPa within 36” of the nozzle.

2. The air stream used for nozzle blast cleaning shall be free of oil, verified using ASTM Test Method d4285.

3. Nozzles shall be a minimum of diameter of 8mm.

4. Hoses shall be a minimum inside diameter of 40mm.

5. Abrasives shall be metallic, garnet, or resin-coated silica sand. Uncoated silica sand is

specifically disallowed.

F. The intent is to remove sufficient material in order to achieve a sound masonry surface free of existing coatings, laitance, glaze, efflorescence, and incompatible compounds or agents.

3.03 POWERWASHING

A. Low-pressure powerwashing may be performed in lieu of abrasive blasting provided the contractor demonstrates the proposed procedure yields similar results to abrasive blasting that are acceptable to the coating manufacturer and the architect.

B. Clean masonry surfaces in accordance with Surface Preparation section above.

C. Apparatus shall be a piston-type positive displacement pump, low-pressure water blasting unit.

3.04 APPEARANCE OF PREPARED MASONRY SURFACE

A. Masonry surface shall have a minimally roughened texture. A roughness standard shall be established by mutual agreement between the Architect and Contractor.

B. Bug holes shall be opened.

C. Post-preparation cleaning: Clean in accordance with ASTM D4258 to remove loose material.

3.05 INSPECTION

A. Visually examine the prepared surface for loose adhering material, thin crusts bridging voids, fins, and projections.

B. Visually examine the prepared surface for paint, oil, grease, and markings.

C. Repeat appropriate cleaning and preparation processes if the above conditions are found.

3.06 ACCEPTANCE

A. Acceptable surface shall be free of paint, laitance, oil, grease, and other materials incompatible with the coating. The surface shall also be free of fins, projects, and loosely adhering, concrete, dirt, and dust particles.

B. The surface shall have a smoothed, textured appearance, roughened only where unavoidable. Bug holes shall be opened.

C. The resulting surface condition must allow the coating manufacturer to provide acceptance in writing. Cleaning, abrasive blasting and/or powerwashing must be repeated as required to obtain acceptance.

D. The final appearance shall be similar to the standard established by mutual agreement between the Architect and the Contractor upon review and acceptance of the sample panel cleaned under 1.05.D.

END OF SECTION

DIVISION 04 – MASONRY

SECTION 042000 – UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK / SUMMARY

A. Extent of each type of masonry work is indicated on drawings and schedule.

B. This Section includes unit masonry assemblies consisting of the following:

1. Concrete unit masonry.
2. Brick masonry.
3. Decorative concrete masonry units.
4. Pre-faced concrete masonry units.
5. Natural stone.
6. Concrete brick.
7. Mortar and grout.
8. Reinforcing steel.
9. Masonry joint reinforcement.
10. Ties and anchors.
11. Miscellaneous masonry accessories.

1.03 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete
B. Section 051200 – Structural Steel
C. Section 061000 – Rough Carpentry
D. Section 072000 – Building Insulation
E. Section 072113 – Ultra Wall Insulation and Air Barrier System Air / Vapor Barrier System
F. Section 076000 – Flashing and Sheet Metal
G. Section 079200 – Joint Sealants
H. Section 081113 – Hollow Metal Doors and Frames
I. Section 081416 – Flush Wood Doors
J. Section 084113 – Aluminum Entrances and Storefronts
K. Section 083600 – Sectional Overhead Doors
L. Section 085113 – Aluminum Windows

1.04 REFERENCES

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 2002.

B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2002.

C. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

D. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

1.05 DEFINITIONS

A. Reinforced Masonry: Masonry containing horizontal joint reinforcing and reinforcing steel in grouted cells.

B. Multi-Wythe Masonry: Masonry wall construction containing adjacent wythes of masonry with the same unit type without a cavity.

C. Composite Masonry: Masonry wall construction containing adjacent wythes of masonry with different unit type without a cavity.

D. Cavity Wall Masonry: Masonry wall construction containing adjacent wythes of masonry with different unit types separated with a continuous air space cavity in-between connected by metal ties.

E. Structural Masonry: Masonry wall construction constructed to be the main supporting structure of other building components such as a floor or roof.

1.06 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.07 SUBMITTALS

A. Comply with the requirements of Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

C. Shop Drawings: Submit shop drawings for the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.

3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement”. Show elevations of reinforced walls.

4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

5. Self-Adhering Sheet Flashing & Waterproofing Membranes: Detail all proposed application conditions, Submit manufacturer’s data for membrane, primers, sealants, adhesives and associated auxiliary materials. Prior to commencing the Work, submit manufacturer’s complete set of standard details for waterproofing systems.

D. Samples: Submit samples of the following materials:

1. Unit masonry samples in small scale form showing full extent of colors and textures available for each type of exposed masonry unit required.

2. Face brick, in the form of straps of five or more bricks. Include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is indicated.

3. Colored masonry mortar samples showing full extent of colors available.

4. Decorative concrete masonry unit samples for each type of exposed masonry unit required; include in each set the full range of exposed color and texture to be expected in completed work.

5. Include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is indicated.

6. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used. Show full extent of colors available.

7. Weep vents in color to match mortar color.

8. Accessories embedded in masonry.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and submission of materials in accordance with this section have been provided for review by the Architect and approved in writing.

F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units. Include material test reports substantiating compliance with requirements.

2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.

6. Joint reinforcement.

7. Anchors, ties, and metal accessories.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with properties specification.

2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

I. Cold-Weather Procedures: Submit a detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Fire Performance Characteristics: Where indicated, provide materials and construction which are identical to those of assemblies whose fire resistance ratings have been determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

E. Field Constructed Mock-ups: Prior to installation of masonry work, erect sample wall panels to further verify selections made under sample submittals to demonstrate aesthetic effects and set quality standards for materials and execution, as well as for color and textural characteristics of masonry units and mortar, and to represent completed masonry work for qualities of appearance, materials, and construction; build mock-ups to comply with the following requirements:

1. Locate mock-ups on site in locations indicated or, if not indicated, as directed by the Architect.

2. Build mock-ups for each type of exposed masonry in sizes of approximately 6' long by 4' high by full thickness, including face and back-up wythes as well as all accessories including but not limited to insulation and horizontal and vertical reinforcement.

3. Include a sealant-filled joint at least 16 inches long in exterior wall mockups.

4. Include through-wall flashing; with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

5. Include metal/wood studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup, when applicable.

6. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.

7. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.

8. Approval of mockups is for construction of full assembly, color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

9. Protect mock-ups from the elements with weather resistant membrane.

10. Retain mock-ups during construction as standard for judging completed masonry work. When directed, demolish mock-ups and remove from site.

11. Pre-installation Conference to be after construction of mock-up but before proceeding with masonry work. Conduct pre-installation conference at Project Site.

F. Qualifications:

1. Masonry Cleaning:

a. Manufacturer: Regularly engaged in manufacturer of masonry cleaning products with at least 5 completed applications of materials to be provided in this project.

b. Applicator: Experienced with use of masonry cleaning products. Provide documentation of such experience when requested by the Architect.

c. For buildings designated Historic by the NYOPRHP, or those eligible for listing on the National Register of Historic Places, the Contractor is obligated to follow the National Park Service Preservation Brief No. 1, Assessing Cleaning and Water-Repellant Treatments for Historic Masonry Buildings.
https://www.nps.gov/orgs/1739/upload/preservation-brief-01-cleaning-masonry.pdf

d. Low-pressure water washing (below 250 psi) and gentle non-ionic detergents are to be used.

2. Tuckpointing:

a. Tuckpointing work is only to be performed by a qualified and experienced tuckpointing craftsman. Field mock-ups required below are to be prepared by those who will perform the masonry work.

b. Contractor is obligated to follow the National Park Service Preservation Brief No. 2, Repointing Mortar Joints in Historic Masonry Buildings.
https://www.nps.gov/orgs/1739/upload/preservation-brief-02-repointing.pdf

1.09 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

1. Payment for these services will be made by Owner.

2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

3. Refer to Specification Sections 014523 & 014529 for additional Special Inspection requirements.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials and accessories to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, or other causes.

C. Store masonry units and cementitious material off the ground, on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If masonry units become wet, do not install until they are dry. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

E. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

F. Cold-applied elastomeric membranes should be stored in closed containers outdoors. Store membrane at temperature of 40°F and above to facilitate handling. Membrane contains petroleum solvents and are flammable; do not use near open flame. Store roll materials horizontally; store adhesives and primers at temperatures of 40°F and above to facilitate handling. Keep all solvents away from open flame or excessive heat.

1.11 PROJECT CONDITIONS

A. Protection of Work: During construction, cover top of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

3. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

4. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

B. Stain Prevention: Prevent grout, mortar, or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings and wash down detergent.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold Weather Requirements:

1. Do not lay masonry units which are wet or frozen. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions.

2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.

3. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Chapter 21 of the Building Code of New York State, latest edition.

D. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40°F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Chapter 21 of the Building Code of New York State, latest edition.

F. Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at the time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10°F (6°C).

1. 40°F (4°C) to 32°F (0°C):

   a. Mortar: Heat mixing water to produce mortar temperature between 40°F (4°C) and 120°F (49°C).
   b. Grout: Follow normal masonry procedures.

2. Do not heat water for mortar and grout to above 160°F (71°C).

G. Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.

1. 40°F (4°C) to 32°F (0°C):

   a. Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

2. 32°F (0°C) to 25°F (-4°C):

   a. Completely cover masonry with weather-resistive membrane for at least 24 hours.

3. 25°F (-4°C) to 20°F (-7°C):

    a. Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

4. 20°F (-7°C) and below:

    a. Except as otherwise indicated, maintain masonry temperature above 32°F (0°C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps, or other methods proven to be satisfactory. For grouted masonry maintain heated enclosure to 40°F (4°C) for 48 hours.

H. Coordination: Ensure installation continuity of the waterproofing membranes scheduled for installation throughout the scope of this section. Work shall be so scheduled as to provide a watertight seal at the end of each working day on the areas worked upon during the day.

PART 2 - PRODUCTS

2.01 GENERAL

A. All specific products indicated within this section are to establish a level of quality. Equivalency is permitted in accordance with General Municipal Law.

2.02 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.03 CONCRETE MASONRY UNITS (CMU)

A. General: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.

B. Concrete Block: Provide units complying with characteristics indicated below for grade, type, face size, exposed face, and, under each form of block included, for weight classification.

1. Size: Manufacturer's standard units with nominal face dimensions and thicknesses indicated on drawings.

2. Type II, non-moisture controlled units.

C. Hollow Load-Bearing Block: ASTM C 90 and as follows:

1. Weight Classification: Lightweight

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. All components (aggregate, cement, etc.) of CMU must be harvested within 500 miles of project site. (Required for LEED Projects only)

5. CMU to contain 20% post-industrial recycled content, by weight. (Required for LEED Projects only)

D. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi.

2. Weight Classification: Medium weight.

3. Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 7-5/8 inches long.

E. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2. **All interior outside corners of CMUs shall have a 5/8" to 1" manufactured bullnosed edge. This requirement supercedes any details which may or may not be provided in the Contract Documents. All masonry bids shall include the cost of all necessary bullnose materials, at no additional costs to the Owner.**

2.04 VENEER BLOCK

A. General: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.

1. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

2. Provide square-edged units for outside corners, except where indicated as bullnose.

3. Provide corner units where applicable and available.

B. Concrete Block: Provide units complying with characteristics indicated below for grade, type, face size, exposed face, and, under each form of block included, for weight classification.

1. Types included but not limited to the following:

a. Split-face
b. Split-face center score
c. Smooth-cast
d. Split Rib
e. Or as indicated on the drawings.

C. Size: Manufacturer's standard units with nominal face dimensions of 16" or 18” long x 8" high x 4" thick (15-5/8" or 17-5/8” x 7-5/8" x 3-5/8” actual).

D. Type I, moisture-controlled units.

E. Exposed Faces: Manufacturer's standard color and texture as selected by Architect unless otherwise indicated.

1. Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture of Architect's samples.

2. Where special patterns are indicated, provide units with exposed faces matching color, texture, and pattern of Architect's samples.

2.05 BRICK MADE FROM CLAY OR SHALE

A. General: Comply with referenced standards and other requirements indicated below applicable to each form of brick required.

1. Size: Provide bricks manufactured to the following actual dimensions:

a. Standard Modular: 2-1/4" x 3-5/8" x 7-5/8".
b. Or as indicated on the drawings.

2. Provide special molded shapes where indicated and for application requiring brick of form, size, and finish on exposed surfaces which cannot be produced from standard brick sizes by sawing.

3. For sills, caps, and similar applications resulting in exposure of brick surfaces which otherwise would be concealed from view, provide uncored or unfrogged units with all exposed surfaces finished.

B. Facing Brick: ASTM C 216, and as follows:

1. Grade SW.
2. Type FBS (normal size and color variations).
3. Compressive Strength: 4,500 psi, minimum, per ASTM C 67.
4. Application: Use where brick is exposed, unless otherwise indicated.
5. Texture and Color: As indicated on drawings or as selected by Architect.

C. Building (Common Brick): ASTM C 62, and as follows:

1. Grade MW except Grade SW where indicated by ASTM C 62 grade requirements for applicable weathering index and exposure.

2. Application: Use where brick is indicated for concealed locations.

2.06 FIRE BRICK MASONRY

A. General: Comply with referenced standards and other requirements indicated below applicable to each form.

B. Fire Brick: Provide units complying with characteristics indicated below for classification, P.C.E. rating, chemical percentage analysis, modulus of rupture, cold crushing P.S.I., porosity % and bulk density.

1. Classification: ASTM C-27-98 (2013), medium duty.
2. P.C.E.: Cone 29 3018 F.
3. Chemical Analysis:

a. Silca: 59.90
b. Alumina: 32.83
c. Iron Oxide: 1.97
d. Titanium Oxide: 1.48
e. Calcium Oxide: .57
f. Magnesium Oxide: .89
g. Sodium Oxide: .49
h. Potassium Oxide: 1.80

4. Modulus of Rupture: 1000–1200 PSI
5. Cold Crushing: 3500-4500 PSI
6. Apparent Porosity: 16-19%
7. Bulk Density: 130-134 lbs/ft
8. Method of Manufacturer: Dry Press

2.07 MORTAR AND GROUT MATERIALS

A. General: Do not use admixtures, including coloring pigments, air entraining agents, accelerators, retarders, water repellant agents, anti-freeze compounds, or other admixtures unless otherwise indicated and approved by Architect.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement and lime.
3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
5. All new face brick mortars shall match existing face brick mortars where restoration work is required, samples of which shall be prepared and thoroughly tested for color, density, and uniformity before submitting samples for the approval of the Architect.

B. Option 1 – Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to project site.

C. Option 2 – Manual Blend: Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

D. Mortar for Unit Masonry: Comply with ASTM C 270, “Standard Specification for Mortar for Unit”, Masonry Proportion Specification, for types of mortar required unless otherwise indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced CMU masonry, use Type S.
3. For brick masonry walls above grade, use Type N.
4. For exterior, above-grade, load-bearing and non-load-bearing CMU walls and parapet walls; for interior load-bearing CMU walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
5. Analysis of the existing mortar to remain is required within the contract if the type required is not clear.

E. Portland Cement: ASTM C 150, “Standard Specification for Portland Cement”, Type I, except Type III, may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color.

1. For colored pigmented mortars, use premixed colored masonry cements of formulation required to produce color indicated, or, if not indicated, as selected from manufacturer's standard formulations by Architect.

2. Available Products: Subject to compliance with requirements, masonry cements which may be incorporated in the work include, but are not limited to, the following:

a. "Lehigh & Flamingo Custom Color Masonry Cement"; Lehigh Portland Cement Company.
b. "Custom Color Masonry Cement"; Spec Mix, LLC.
c. “Glen-Gery Color Mortar Blend”; Glen–Gery Corporation.

F. For Manually Blended Colored Mortar Use Colored Mortar Pigments (for use with veneer brick and veneer block): Use pigments complying with ASTM C979, “Standard Specification for Pigments for Integrally Colored Concrete”. Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment to cement ratio of 1 to 10 by weight. Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.

1. Available Products: Subject to compliance with requirements, colored mortar pigments which may be incorporated in the work include, but are not limited to, the following:

   a. "SGS Mortar Colors”, Solomon Colors, Inc.
   b. "Canister Colors"; Spec Mix, LLC.
   c. "True Tone Mortar Colors”; Davis Colors.
   d. “Bayferrox Iron Oxide Pigments”; Bayer Corporation, Industrial Chemical Division.

G. Water: Clean and potable.

H. Hydrated Lime: ASTM C 207, “Standard Specification for Hydrated Lime for Masonry Purposes”, Type S.

I. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

J. Aggregate for Mortar: ASTM C 144, “Standard Specification for Aggregates for Masonry Mortar”.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than ¼ inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.

K. Aggregate for Grout: ASTM C 404, “Standard Specification for Aggregates for Masonry Grout”.

L. Grout for Unit Masonry: Comply with ASTM C 476, “Standard Specification for Grout for Masonry”, for grout for use in construction of reinforced and non-reinforced unit masonry. (Refer to Table 1 Conventional Grout Proportions by Volume. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

TABLE 1 Conventional Grout Proportions by Volume

Type	Parts by Volume of Portland Cement or Blended Cement	Parts by Volume of Hydrated Lime or Lime Putty	Aggregate, Measured in a Damp, Loose Condition	
			Fine	Coarse
Fine grout	1	0–1⁄10	2-1⁄4 –3 times the sum of the volumes of the cementitious materials	. . .
Coarse grout	1	0–1⁄10	2-1⁄4 –3 times the sum of the volumes of the cementitious materials	1–2 times the sum of the volumes of the cementitious materials

1. Use fine grout in grout spaces less than 2" in horizontal direction unless otherwise indicated.
2. Use coarse grout in grout spaces 2" or more in least horizontal dimension unless otherwise indicated.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
4. The compressive strength of the grout shall match the compressive strength of the masonry f'm, but not less than 2,000 psi. The compressive strength of grout so specified should be determined according to ASTM C1019 (UBC 21-18).

M. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

a. Euclid Chemical Compnay; Accelguard 80.
b. Grace Construction Products, a unit of W.R. Grace & Co., Morset.
c. Sonneborn, division of ChemRex; Trimix-NCA.

2.08 FIRE WALLS

A. General: Comply with the referenced standards and other requirements indicated below as applicable to each type of fire wall construction required.

B. Provide masonry units and construction as required by Underwriter's Laboratories, Inc.; Design as indicated on the Contract Drawings.

1. If no specific designs are represented on the drawings, the following designs shall be utilized:
   a. 3-Hour Firewall – UL Design No. U904.
   b. 2-Hour Firewall – UL Design No. U905 or UL Design No. U906.

C. Provide complete fire wall assembly submittals independent of typical masonry submittals.

1. Only eligible manufacturers with products bearing the UL mark will be accepted for use in the construction of fire walls.

2.09 JOINT REINFORCEMENT, TIES, AND ANCHORING DEVICES

A. Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie, and anchor for size and other characteristics.

1. Zinc-Coated (mill galvanized) Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 641 for zinc coating of class indicated below:

a. Class 1: 0.40 oz. per square foot of wire surface.
b. Application: Use for masonry not exposed to exterior or earth.

2. Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 153 for zinc coating applied after prefabrication into units.

a. Class B-2: 1.5 oz. per square foot of wire surface.
b. Application: Use for all masonry back-up exposed to exterior.

3. Uncoated Steel Reinforcing Bars: Of size and locations as indicated on drawings, ASTM A615, Grade 60, deformed.

4. Stainless Steel Reinforcing Bars: AISI Type 304, ASTM A580, for historical masonry reconstruction projects.

B. Joint Reinforcement: Reinforcement to conform to Standard Specification ASTM A951 & ACI/ASCE 530 (Building Code Requirements for Masonry Structures). Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet with prefabricated corner and tee units, and complying with requirements indicated below:

1. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.

2. Wire (Carbon Steel): Pre-fabricated construction from cold-drawn steel wire conforming to ASTM A 82:

   a. Tensile Strength: 80,000 psi.
   b. Yield Point: 70,000 psi, minimum.

3. Wire Diameter for Cross & Side Rods: Provide standard weight 9 gauge (.148”), typical.

C. Single-Wythe Masonry: Provide type as follows with single pair of side rods:

1. Provide Hohmann & Barnard, Inc. **#220 Ladder Mesh Reinforcement** - Ladder design with perpendicular cross rods spaced not more than 16" o.c.

2. Finish: Provide mill galvanized, per ASTM A 641.

D. Multi-Wythe Masonry: Provide type as follows:

1. Provide Hohmann & Barnard, Inc. **#120 Ladder Mesh Reinforcement** - Ladder design with perpendicular cross rods spaced not more than 16" o.c.

2. Finish: Provide mill galvanized, per ASTM A 641.

E. Masonry Joint Reinforcement for Cavity-Wall Masonry:

1. Provide Hohmann & Barnard, Inc. **# 270-ML Ladder Adjustable Eye-Wire Reinforcement** - Ladder design with perpendicular cross rods spaced not more than 16" o.c., Cross rods to be welded at 16” o.c; first cross rods to be welded 12” in from each end to allow for lap splices.

2. Finish: Provide hot-dip galvanized, after fabrication, per ASTM A 153.

F. Steel Stud Masonry Anchor System: (Where required) Provide **X-Seal Anchor System with Byna-Lock Wire Ties**, as manufactured by *Hohmann & Barnard, Inc.*, 30 Rasons Court, Hauppauge, New York, 11788; tel (800) 645-0616; fax (631) 234-0683. website: www.h-b.com.

G. Reinforce each course of block cut back for fire extinguisher cabinets, electrical boxes and toilet accessory type recessed items. Mortar 9 gauge reinforcing wire in joints, that is 24-inches longer than recessed opening width on both sides.

H. All steel reinforcement to contain minimum 90 percent combined post-consumer and post-industrial recycled content. (Required for LEED Projects only)

2.10 TIES AND ANCHORS

A. Materials: Provide ties, reinforcing and anchors, specified in subsequent articles, made from materials that comply with this article, unless otherwise indicated.

1. Carbon Steel Wire: ASTM A 82.

2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
3. Products meeting specified products quantities by Hohmann & Barnard, Inc. or Heckmann Building Products Inc.
4. Anchors and ties shall be 16 inches on center each way.
5. Horizontal reinforcing shall be 16 inches on center.

B. Joint Stabilizing Anchors: Provide Hohmann & Barnard, Inc., **Slip-Set™ Stabilizer** joint stabilizing anchors at veneer control joints and block interior wall, running wall, corner, "Tee", and "Ell" joints.

1. Provide joint stabilizing anchors at connection of new masonry to existing masonry or concrete walls.

2. Refer to Structural Drawings for additional requirements.

C. Rigid Anchors: Provide Hohmann & Barnard, Inc., #**344 - Rigid Partition Anchor,** Z-Type bent steel shape 1-1/2 inches wide by 1/4 inch thick by 24 inches long or length required, with ends turned up 2 inches or with cross pins. (Rigid anchors can be used to connect T-intersections of CMU shear walls in lieu of masonry bonding or bond beams. (Used at T-intersections of other CMU walls and piers where indicated on drawings, although masonry bonding and T-shaped masonry joint reinforcement may be used.)

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M. (Rigid anchors may not be fully embedded in mortar or grout and, therefore, require a coating for corrosion protection.)

D. Mesh Wall Ties: Provide Hohmann & Barnard, Inc., **MWT - Mesh Wall Tie,** ½" square x 16-gauge, by width & length required; hot dip galvanized to ASTM A153 B2 finish.

E. Corrugated Wall Ties: Provide Hohmann & Barnard, Inc., **CWT – Corrugated Wall Tie,** 7" long x 16-gauge, or length as required; hot dip galvanized to ASTM A153 B2 finish.

F. Beam Strap Anchors: Provide Hohmann & Barnard, Inc., **#364 Corrugated Gripstay Anchor** 1-1/4 inch x 14 gauge, by length required; hot dip galvanized to ASTM A153 B2 finish.

G. Breakaway Fire Wall Anchors: Provide Heckmann Building Products, **#134 Channel Slot Corrugated Anchor** for masonry to structural steel beams and **#196 Corrugated Notch Column Anchor** for masonry to structural steel columns, 1-1/4 inch x 16 gauge, by length required; Zinc Alloy 710.

H. Masonry Column Anchors: Provide Hohmann & Barnard, Inc., #**356L - Column Anchor,** 1-1/4 inch x 12 gauge, by length required; hot dip galvanized to ASTM A153 B2 finish or Hohmann & Barnard, Inc., #**355L - Column Anchor,** 1-1/4 inch x 12 gauge, by length required; hot dip galvanized to ASTM A153 B2 finish.

I. Partition Top Anchors: Provide Hohmann & Barnard, Inc., **PTA Series Anchors - PTA 422,** 12-gauge steel plate; hot dip galvanized to ASTM A153 B2 finish.

J. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

a. Provide Hohmann & Barnard, Inc., **HB-200/DA-213 Adjustable Veneer Anchor,** with two stainless steel fasteners #12 diameter each.

2.11 MISCELLANEOUS ANCHORS

A. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

B. Wedge Anchors: Anchors shall meet the physical requirements of Federal Specification A-A-1923A, Type 4. Anchors shall be non-bottom bearing type with a single piece steel expansion clip providing 360-degree contact with the base material and shall not require oversized holes for installation. Carbon steel anchors shall have an electroplated zinc finish or shall be mechanically galvanized in accordance with ASTM B695, Class 55, Type 1, as appropriate. Stainless steel anchors shall be type 303, 304 or 316. Anchors shall have an evaluation report issued by ICC-ES and have been tested in accordance with ICC-ES AC01 for all mandatory tests and including the following:

1. Seismic tension & shear
2. Combination of tension and shear loads
3. Critical and minimum edge distance

Unless otherwise noted, wedge anchors shall be **"Wedge-All" Wedge Anchors** by Simpson Strong-Tie (ICC-ES ESR-1396).

C. Sleeve Anchors: Anchors shall meet the physical requirements of Federal Specification A-A-1922A. Anchors shall be non-bottom bearing type with a single piece steel expansion sleeve providing 360-degree contact with the base material and shall not require oversized holes for installation. Carbon steel anchors shall have an electroplated zinc finish. Stainless steel anchors shall be type 304. Anchors shall have been tested in accordance with ICC-ES AC01 for the following:

1. Static Loads
2. Critical and minimum edge distance and spacing

Unless otherwise noted, sleeve anchors shall be **"Sleeve-All" Sleeve Anchors** by Simpson Strong-Tie.

D. Postinstalled Veneer Anchors For Reconstruction Work: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.12 CONCEALED FLASHING MATERIALS

A. Thru Wall Flashing Membrane (where so noted on the drawings):

1. Through-wall Flashing Membrane (Self-Adhering) shall be **Blueskin® TWF**, an SBS modified bitumen, self-adhering sheet membrane complete with a yellow engineered thermoplastic film; as manufactured by Henry Company, 909 North Sepulveda Blvd. Suite 650, El Segundo, CA, 90245; tel. (800) 598-7663; email: techservices@henry.com. Provide pre-fabricated inside & outside corners and end dams mitered and fully adhered, including **Stainless Steel 3" Drip Pl**

ate and all required bonding accessories as standard to Base Bid. Provide pre-formed drip plate inside and outside corners with smooth uninterrupted hemmed drip edge.

Membrane shall have the following physical properties:

a. Membrane Thickness: 0.0394 inches (40 mils),
b. Film Thickness: 4.0 mils,
c. Flow (ASTM D5147): Pass @ 212 degrees F,
d. Puncture Resistance: 134 lbf to ASTM E 154,
e. Tensile Strength (film): 5000 psi minimum ASTM D 882,
f. Tear Resistance: 45lbs.-MD, 17lbs.-CD to ASTM D1004,
g. Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M

B. Sheet Metal Counter Flashing (where so noted on the drawings): Fabricated from the following metal complying with requirements specified in Division 7 Section "Flashing and Sheet Metal" and below:

1. Copper: 7 oz. weight copper fabric flashing; asphalt-free (red) York Multi-Flash 500 series as manufactured by York Manufacturing Inc., for fully concealed flashing, and 16 oz. weight copper for cap flashing. Provide copper flashing where sloped glazing occurs.

2. At parapet cap stones use 16 oz. copper dove-tail flashing manufactured by Cheney Flashing Company.

3. Fabricate through-wall metal flashings with deformation in both directions for integral mechanical mortar bond.

4. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section - 076000 "Flashing and Sheet Metal".

2.13 TRANSITION MEMBRANES

A. Primary sheet air/vapor barrier membrane shall be **Blueskin® SA**, an SBS modified bitumen, self-adhering sheet membrane complete with a blue engineered thermoplastic film; as manufactured by Henry Company, 909 North Sepulveda Blvd. Suite 650, El Segundo, CA, 90245; tel. (800) 598-7663; email: techservices@henry.com.

B. Primer: Primer for self-adhering membranes at temperatures above 25°F shall be Aquatac™ Primer manufactured by Henry, a polymer emulsion based adhesive, quick setting, having the following physical properties:

1. Color: Aqua.
2. Weight: 8.7 lbs/gal.
3. Solids by weight: 53%.
4. Water based, no solvent odors.
5. Drying time (initial set): 30 minutes at 50% RH and 70°F.

2.14 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control Joint Strips: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and

configuration as indicated.

C. Bond Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Control Joint Block Shear Connector: Provide sash block either side of control joint and insert Hohmann & Barnard, Inc. **RS Series - Rubber Control Joint** in joint full height.

E. Control Joint Foam (Mortar Excluding) Filler: Provide Hohmann & Barnard, Inc., **NS - Closed Cell Neoprene Sponge** expansion joint in veneer control joints held back for bond breaker and sealant. Apply sealant at cavity face of block prior to applying vapor barrier to make building airtight.

1. Compressible Control Joint Foam Filler: Provide Hohmann & Barnard, Inc., **NS - Closed Cell Neoprene Sponge** with adhesive backing under shelf angles to allow for vertical veneer movement. Hold back for sealant and bond breaker.

F. Weepholes: Provide the following for weepholes:

1. Full Head Joint Weep Holes: Provide a full height **open** cell weep hole at base of wall above flashing and above steel lintels provided with thru-wall flashing.

2. Weep Vents (Top of Wall): Available Products; subject to compliance with requirements, weephole/ventilators which shall be incorporated in the work include, but are not limited to, the following:

a. “Hohmann and Barnard” No. 343, No. 343W Louvered Weep Hole. For use with Standard white and grey mortar.
b. “Hohmann and Barnard” No. QV-Quadrovent. For use with colored mortars. Color as selected by Architect.

G. Cavity Drainage Material: Free-draining mesh, made from high density polyethylene strands (1” x 10” x 60”) that will not degrade within the wall cavity; 90% open mesh weave.

1. Provide the following configuration:

a. Strips, full-depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.

2. Products:

a. Mortar Net USA, Ltd.; “Mortar Net”
b. Hohmann and Barnard; “Mortar Trap”

H. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Available Products:

a. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.15 INSULATION

A. Cavity wall closed cell expanded polystyrene insulation as indicated on drawings and specified in related sections. Refer to Specification Section 072113. Thickness as indicated on drawings.

1. Cavity wall assembly will utilize continuous rigid board cavity insulation adhered to CMU with all joints and penetrations sealed with spray foam sealant.

2.16 MASONRY CLEANERS

A. Acidic Cleaner: Manufacturer's standard strength general purpose cleaner designed for new masonry surfaces of type indicated; composed of blended organic and inorganic acids combined with special wetting systems and inhibitors; expressly approved for intended use by manufacturer of masonry units being cleaned.

1. Available Products: Subject to compliance with requirements, a product which may be used to clean unit masonry surfaces includes, but is not limited to, the following:

a. "Sure Klean" No. 600 Detergent; ProSoCo, Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Prepare written report, endorsed by Installer, listing any conditions requiring correction prior to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Commencement of installation indicates acceptance of conditions provided.

3.02 INSTALLATION, GENERAL

A. Do not wet concrete masonry units.

B. Cleaning Reinforcing: Before placing, remove loose rust, ice, and other coatings from reinforcing.

C. Thickness: Build cavity and composite walls, and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated.

1. Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
2. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

3. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.

D. Matching Existing Masonry Work: Match coursing, bonding, color, and texture of new masonry work with existing work unless otherwise indicated or if there is a unit size different or joint thickness variation. Tooth-in new masonry when tying into existing unless otherwise indicated on the drawings.

E. Tuck Pointing: Mortar shall be pre-hydrated. The specified ingredients shall be mixed with only enough water to produce a damp mass of such consistency that it will retain its form when pressed into a ball by the hands but will not flow under the trowel; then allowed to stand for not less than 1 hour nor more than 2 hours and remixed at once with the addition of enough water to produce satisfactory workability for immediate use. Tuck pointing is intended for use in repair work.

F. Select and arrange units for exposed brick unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed unless otherwise specifically indicated on documents.

3.03 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

B. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arises, do not exceed 1/4" in 10", or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, or 1/2" in 40' or more. For vertical alignment of head joints, do not exceed plus or minus 1/4" in 10', 1/2" maximum.

C. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls, do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

E. Variation In Mortar Joint Thickness:

1. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

F. Variation In Face Dimensions: For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

G. Variation In Alignment: For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and

to accurately locate openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half size units at corners, jambs, and, wherever possible, at other locations.

B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

C. Pattern Bond: Lay exposed masonry in the bond pattern shown, or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back ½-unit length in each course; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar unless otherwise indicated.

2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

3. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

F. Build non-load-bearing interior partitions full height of story to within 1” of underside of solid floor or roof structure above, unless otherwise indicated. Coordinate this work with all required firestopping requirements.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.

3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

G. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes.

1. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

2. If construction sequence does not allow simultaneous construction of intersecting or abutting walls, provide mesh wall ties @ 16” o.c. vertical install in initial wall and leave hanging out for incorporation into secondary wall.

3.05 MORTAR BEDDING AND JOINTING

A. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and place units. Do not slush head joints.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

E. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

F. Interior Exposure Joints: Provide concave joints horizontal and vertical.

G. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.06 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16" o.c. vertically.

B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes.

1. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

2. If construction sequence does not allow simultaneous construction of intersecting or abutting walls, provide mesh wall ties @ 16” o.c. vertical install in initial wall and leave hanging out for incorporation into secondary wall.

3.07 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.

2. Masonry Joint Reinforcement: Installed in horizontal joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across

both wythes.

b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Bond adjacent wythes of composite masonry together using full collar joints.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches o.c.

2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

3. Provide rigid metal anchors not more than 24 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

4. If construction sequence does not allow simultaneous construction of intersecting or abutting walls, provide mesh wall ties @ 16” o.c. vertical install in initial wall and leave hanging out for incorporation into secondary wall.

3.08 CAVITY WALLS

A. Tie wythes of cavity walls together using one of the following methods:

1. Ladder Type Pintel & Eye Joint Reinforcement: Installed in horizontal mortar joints where bed joints of both wythes align, use adjustable (two piece) ladder-type reinforcement on back-up masonry with pintel & eye extending across cavity securing veneer.

2. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.

3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Attempting to remove mortar fins from cavity or to trowel them flat against brick usually results in increased mortar droppings at base of cavity; keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavity flush. Bevel beds away from cavity, to minimize mortar protrusions into cavity.

C. Provide weepholes (full head open cell joints) in exterior wythe of cavity wall located immediately above ledges and flashing, spaced 24" o.c., unless otherwise indicated.

D. Provide weep vents in exterior wythe of cavity wall located at top of cavity walls at 24” o.c., unless otherwise indicated.

3.09 CAVITY WALL INSULATION

A. Cavity insulation shall be installed continuously between lines of horizontal joint reinforcement butting edges flush. Adhere to back-up block and seal all joints with adhesive/sealer compatible with insulation, product as recommended by the insulation manufacturer.

B. Refer to Division 07 Section 072100 – Building Insulation & Section 072113 – Ultra Wall Insulation and Air Barrier System for installation requirements applicable to continuous rigid insulation.

C. Provide insulation thickness as indicated on drawings.

3.10 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcements as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".

B. Cut or interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.

D. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections.

E. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

1. Space continuous horizontal reinforcement as follows:

    a. For multi-wythe walls (solid or cavity) where continuous horizontal reinforcement acts as structural bond or tie between wythes, space reinforcement as required by code but not more than 16" o.c. vertically.
    b. For foundation and parapet walls, space reinforcement at 8" o.c. vertically unless otherwise indicated.

2. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints.

    a. In addition to wall reinforcement, provide additional reinforcement at openings as required to comply with the above.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical and horizontal expansion, control, and isolation joints in masonry where shown. Build-in related items as the masonry work progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

1. Build-in horizontal pressure relieving joints where indicated; construct joints by either leaving an air space or inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

    a. Locate horizontal pressure relieving joints beneath shelf angles supporting masonry

veneer and attached to structure behind masonry veneer.

2. Build in vertical pressure relieving joints. Expansion joints shall be located in sizes and locations as shown on drawings.

3. Vertical control joints: unless otherwise noted, control joints shall be located as shown on drawings and/or in accordance with the ACI guidelines and specified herein. Location of all control joints shall be reviewed by Architect prior to proceeding with work.

   a. Vertical interior and exterior masonry control joints shall be ½" wide and filled with appropriate caulk.

   b. Control joint spacing for exterior and interior walls:

Wall Height (FT)	Horizontal Joint reinforcing 16" O.C.
Up to 8 feet	25 ft O.C.
8ft to 12 ft	30 ft. O.C.
Over 12 ft.	35 ft. O.C.

   c. Control joints for interior and exterior masonry shall be located at the following points of weakness or high stress concentrations:

      1) At all abrupt changes in wall height.

      2) At all changes in wall thickness, such as those at pipe or duct chases and those adjacent to columns or pilasters.

      3) Above joints in foundations and floors.

      4) Below joints in roof and floors that bear on the wall.

      5) At a distance of not over one-half the allowable joint spacing from bonded intersections or corners.

      6) At one or both sides of all door and window opening unless other crack control measures as used, such as joint reinforcement or bond beams.

B. Control joints in 2 hour fire rated CMU walls shall be as follows: Joint size maximum ½" with nominal ¾" diameter polyethylene backer rod compressed and installed into joint with minimum of ¼" thick fill materials applied within the joint flush with both surfaces of the wall as manufactured by "3M Company" - model # FD-150+. Note: All installations shall be in accordance with UL guidelines for joint systems.

3.12 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members as detailed and indicated within the Construction Documents or where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c.

horizontally.

4. Coordinate anchors with flashing and air/vapor barrier requirements. Seal any penetrations necessary in flashing and air/vapor barriers.

B. Firewalls: Provide melt-away anchors at all firewalls to anchor masonry to structural members as detailed and indicated within the Construction Documents when required for structural bracing.

3.13 LINTELS

A. Install steel lintels of size and configuration shown where indicated in Construction Documents. Provide galvanized steel lintels at all exterior conditions where exposure to moisture is possible.

B. Provide minimum bearing of 6" at each jamb unless otherwise indicated.

3.14 FLASHING OF MASONRY WORK

A. Refer to Division 07 Section 072113 – Ultra Wall Insulation and Air Barrier System for installation requirements applicable to through wall flashing.

B. General: Provide concealed self-adhering through wall flashing in masonry work continuous at base of wall at or above shelf angles, lintels, ledges, and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior.

1. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Seal penetrations in flashing with mastic before covering with mortar.

2. Place horizontal leg of through wall flashing on sloping bed of mortar and cover with mortar. Set stainless steel drip plate into minimum of ¼” bead of water block sealant, apply spray primer and allow to dry 4 to 5 minutes; within 30 minutes of setting primer set self-adhering through wall flashing onto drip plate set back from face of exterior face of masonry.

3. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end then provide end dams at lintels and sills. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up typically two full cmu back-up courses (16”) but a minimum of 4" where restricted, and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills turn up ends not less than 2" to form a pan.

4. Install flashing to comply with manufacturer's instructions.

5. Provide fully open cell weep hole head joints of the first course of masonry immediately above concealed flashings. Space 24" o.c. unless otherwise indicated.

6. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

7. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 “Cavity Drainage Material” Article.

8. Install vents in head joints at top course of just below or where indicated in exterior wythes at spacing indicated or 24” o.c. Use specified weep/vent products to form vents.

   a. Close cavities off vertically and horizontally with treated wood blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.15 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602. Place reinforcement of size and type and spacing as indicated in structural drawings.

C. Grouting: Grout reinforced cores full height in coordination with and as indicated on structural drawings. Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

2. Limit height of vertical grout pours to not more than 60 inches.

3. The use of mortar to fill the cells is not permissible.

3.16 INSTALLATION OF SELF-ADHERING TRANSITION MEMBRANES

A. Refer to Division 7 Section 072113 – Ultra Wall Insulation and Air Barrier System for installation requirements applicable to self-adhering transition membranes.

B. General: Provide self-adhering transition membranes locations including window & door openings, top of wall covering wood blocking tied into roofing, changes in materials, across expansion joints, around penetrations, structural steel exposed within the cavity and wherever indicated on the construction documents.

1. Coordinate installation of transition membranes with other materials utilized as part of the air/vapor barrier system utilizing compatible products.

2. Install transition membranes to comply with manufacturer's instructions.

3.17 REPAIR, POINTING, AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weepholes, and completely fill with mortar. Point up all joints including corners, openings, and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly sets and cured, clean masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of installed masonry.

3. Fully clean installation of exterior masonry with specified cleaner; apply and rinse, remove in accordance with manufacturer instructions.
4. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

5. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

6. Use bucket and brush hand cleaning method described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale, except use masonry cleaner as indicated in Part 2 “Masonry Cleaners” Article.

7. Clean exterior finished concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

E. Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion. Protect waterproofing membrane and drain board work from other trades during construction. Backfill with specified materials, protect membrane from damage.

3.18 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, recycle or remove all surplus materials from the Project site(s).

END OF SECTION

DIVISION 04 – MASONRY

SECTION 047200 – ARCHITECTURAL CAST STONE

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes the following:

1. Manufactured cast stone veneer at exterior walls.
2. Manufactured cast stone date stone.
3. Manufactured cast stone coping, cornices, sills and lintel components, etc.
4. Reinforcement, and accessories
5. Mortar and joint pointing.

B. All labor, materials, and equipment to provide the cast stone shown on the architectural drawings and as described in this specification.

C. Manufacturer shall furnish and deliver cast stone covered by this specification.

D. Installing contractor shall unload, store, furnish all anchors, set, patch, clean and seal (optional) the Cast Stone as required.

1.02 PRODUCT DESCRIPTION

A. General: A refined architectural concrete building unit manufactured to simulate natural cut stone, used in Division 04 masonry applications. Cast stone unit colors, textures, and shapes shall conform to those indicated on the drawings and described in this specification.

B. Design Requirements: Cast stone units and their anchorage shall be designed to withstand dead and live loads, lateral loads, applicable snow load and other loads calculated in accordance with governing code of the area where project occurs. Design requirements shall be indicated on manufacturers shop drawings.

C. Provide special shapes and configurations indicated on the drawings.

1.03 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections include, but not limited to, the following:

1. Section 042000 – Unit Masonry
2. Section 055000 – Metal Fabrication
3. Section 076000 – Flashing
4. Section 079200 – Joint Sealants

1.04 REFERENCE STANDARDS

A. Reference Standards: Comply with applicable provisions and recommendation of the following, except as otherwise shown or specified.

1. Cast Stone Institute Standard Specifications
2. ACI 318 – Building Code Requirements for Reinforced Concrete
3. ASTM A 615/A 615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete
4. ASTM A1064 / A1064M – Standard Specification for Carbon Steel Wire and Welded Wire
1. Reinforcement, Plain and Deformed, for Concrete
2. ASTM C 33 – Specification for Concrete Aggregates
3. ASTM C595/C595M – Specification for Blended Hydraulic Cements ASTM
4. C1157/C1157M – Performance Specification for Hydraulic Cement
5. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method
6. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
7. ASTM C260 – Standard Specification for Air-Entrained Admixtures for Concrete
8. ASTM C 270 – Specification for Mortar for Unit Masonry
9. ASTM C 426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units
10. ASTM C 494C/M – Specification for Chemical Admixtures for Concrete
11. ASTM C618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
12. ASTM C666/666M – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
13. ASTM C 979 – Standard Specification for Coloring Pigments for Integrally Colored Concrete
14. ASTM C989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete
15. ASTM C1116 – Standard Specification for Fiber Reinforced Concrete and Shotcrete
16. ASTM C 1194 – Standard Test Method for Compressive Strength of Architectural Cast Stone
17. ASTM C1195 – Standard Test Method for Absorption of Architectural Cast Stone
18. ASTM C 1364 – Standard Specification for Architectural Cast Stone
19. ASTM D1729 – Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials
20. ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates
21. ASTM D7957/D7957M – Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement
22. TMS 404-504-604 – Standards for Architectural Cast Stone Design – Fabrication - Installation
23. Cast Stone Institute^{SM} Technical Manual (Current Edition)

1.05 DEFINITIONS

A. Cast Stone – A refined architectural concrete building unit manufactured to simulate natural cut stone, used in Division 04 masonry applications.

1. Dry Cast – manufactured from zero slump concrete.

    a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
    b. Machine casting method: Manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.

2. Wet Cast – Manufactured from measurable slump concrete.

    a. Wet casting method: Manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

3. Specifier Note: Slump, manufacturing method, and apparatus shall be selected by the manufacturer and not specified by the purchaser.

1.06 QUALITY ASSURANCE

A. Pre-Installation Conference: Immediately prior to any cast stone application, a pre-installation meeting shall be held at the job site. The meeting shall be arranged by the General Contractor and attended by the Cast Stone Manufacturer's Technical Representative, Cast Stone Installer, General Contractor, Owner, Architect and Construction Manager (where applicable). The purpose of this meeting is to discuss specific expectations and responsibilities, construction procedures, specified requirements, and application procedures.

B. Manufacturer's Representation: Prior to installation, the General Contractor shall arrange for the manufacturer's technical representative to demonstrate proper installation and finishing procedures for each type and component of stone to be placed.

C. Manufacturer's Qualifications: A Cast Stone Institute Certified Producer, with a minimum of ten (10) years experience in producing cast stone of the types required for project. Cast Stone shall be produced in a plant certified by the Cast Stone Institute®. Plant shall have adequate capacity to furnish quality, shapes, sizes and quantity of cast stone required in accordance with the project schedule. Manufacturer shall submit a written list of projects similar in scope and at least three (3) years of age, along with owner, architect and contractor references.

D. Manufacturing Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications. Where a conflict may occur, the Contract Documents shall prevail.

E. Installer's Qualifications: Company specializing in the installation of cast stone products, with minimum of five (5) years of successful experience in handling and installing cast stone units on projects of comparable size and scope.

F. Certifications: Provide manufacturer's standard certificates of compliance with Cast Stone Institute standards.

G. Mock-up: Provide full size unit(s) for use in construction of sample wall. The approved mock-up shall become the standard for appearance and workmanship for the project.

1. Construct cast stone mock-up wall panel, of size appropriate to include stone attachment, accessories, flashings, corner condition, and typical jointing.
2. Locate where directed. Maintain and protect approved sample wall panel for duration of the work. Completed work shall match approved sample panel.
3. If mock-up is disapproved, provide new mock-up. Repeat procedure until mock-up is approved.
4. Remove mock-up only by direction of the Architect. Removal shall be complete, with all materials disposed off-site and the site restored.

H. Job Site Testing – One sample from production units may be selected at random from the field for each 500 cubic feet delivered to the job site.

1. Three field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
2. Three field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

1.07 SUBMITTALS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. Submit for approval the following:

1. Submit 12”x12” pieces of the cast stone that are representative of the general range of finish and color to match existing cast stone or proposed to be furnished for the project.
2. Test Reports: Submit manufacturers test results of cast stone components previously made by the manufacturer using materials from same sources proposed for use in project.
3. Product Data: Submit manufacturer's standard product literature for stone, accessories, sealant and cleaner.
4. Shop Drawings: Prior to fabrication and delivery, submit manufacturers shop drawings clearly indicating:

    a. Profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of components and their locations in project as indicated on layout drawings.
    b. Unless otherwise shown on the contract drawings:

        1) Provide suitable wash on all exterior sills, coping, projecting courses, and pieces with exposed top surfaces.
        2) Provide drips as needed.
        3) Provide casting of sleeves to accommodate required penetrations and grout solid after installation.

5. Shop Tickets: Submit manufacturer's shop tickets including profiles, cross sections, modular unit lengths, reinforcement, exposed faces, and annotation of components proposed for use in project according to cross sections as indicated on the Drawings.
6. Catalog Cuts: Submit manufacturer's catalog cuts showing page and product numbers of units proposed for use in project.
7. Warranty Period: Provide manufacturer written warranty against deterioration or developing surface defects that would detract from its appearance for a minimum period of ten (10) years from date of manufacture.

C. The cast stone manufacturer shall be responsible for all calculations, engineering and detailing of anchor methods/supports and reinforcing. Shop drawings shall bear the seal and signature of N.Y.S. P.E.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration.
2. Protect corners from damage.
3. Number each piece individually to match shop drawings and scheduled installation sequence.
4. Provide an itemized list of product to support the bill of lading.

B. Storage:

1. Store cast stone components and installation materials in accordance with manufacturer’s instructions.
2. Store cast components on pallets with nonstaining, waterproof covers.
3. Ventilate under covers to prevent condensation.

4. Prevent contact with dirt.

C. Handling:

1. Protect cast stone components during handling and installation to prevent chipping, cracking, staining or other damage.

1.09 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F(4 deg C) and above and will remain so until cast stone has dried, but not less than 7 days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.10 SEQUENCING and SCHEDULING

A. Comply with manufacturer's recommendations and procedure recommended by the Cast Stone Institute. Describe special sequences and procedures when units must be set in sequence to attain desired appearance or structural integrity such as loading limits, shoring/supports or similar requirements.

B. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delay in work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Corinthian Cast Stone Corp. 115 Wyandanch Ave, Wyandanch NY 11798. Phone: 631-920-2340 and Fax: 631-776-7101

B. Approved equal by Architect

2.02 ARCHITECTURAL CAST STONE

A. Physical Properties - Provide the following complying with ASTM C 1364:

1. Compressive Strength, ASTM C 1194: 6,500 psi minimum for products at 28 days.
2. Absorption, ASTM C 1195: 6% maximum by cold water method or 10% maximum by the boiling method for products at 28 days.
3. Air Content – Provide sufficient air content to meet the freeze-thaw requirements for wet cast products, when the air content is tested in accordance with Test Method C173/C173M or Test Method C231/C231M. Air entrainment is not required for Vibrant Dry Tamp (VDT) products.
4. Freeze-thaw – ASTM C666/C666M in accordance with ASTM C1364. The CPWL shall be less than 5.0% after 300 cycles of freezing and thawing.
5. Linear Drying Shrinkage – ASTM C426: Test and report in accordance with ASTM C1364.

B. Job site testing – One sample from production units may be selected at random from the field for each 500 cubic feet (14 m 3) delivered to the job site.

1. Three field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
2. Three field cut cube specimens from each of these samples shall have an average maximum cold- water absorption of 6.0%.
3. Field specimens shall be tested in accordance with ASTM C1194 and C1195.

2.03 RAW MATERIALS

A. Portland cement – Type I or Type III, white and/or grey, ASTM C150 or ASTM C595 Blended Hydraulic Cement (Type 1L).

B. Coarse aggregates - Granite, quartz or limestone, ASTM C33, except for gradation, and are optional for the Vibrant Dry Tamp (VDT) casting method.

C. Fine aggregates - Manufactured or natural sands, ASTM C33, except for gradation.

D. Colors - Inorganic iron oxide pigments, ASTM C979 except that carbon black pigments shall not be used.

E. Admixtures: Comply with the following:

1. ASTM C260 for air-entraining admixtures.
2. ASTM C494/C495M Types A - G for water reducing, retarding, accelerating, and high range admixtures.
3. Other admixtures: Integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
4. ASTM C618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
5. ASTM C989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water: Potable.

G. Reinforcement:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in.
2. ASTM D7957/D7957M: Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement.
3. Welded Wire Fabric: ASTM A1064 / A1064M where applicable for wet cast units. Fiber reinforcement (optional): ASTM C1116.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302, 304 or 316.

2.04 COLOR AND FINISH

A. Color and finish to be selected by Architect from manufactures entire available color palette or custom colors.

B. Mortar color shall match stone unless otherwise indicated.

C. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. and the density of such voids shall be less than 3 occurrences per any 1 $in.^2$ and not obvious under direct daylight illumination at a 5 ft distance.

D. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft distance.

1. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.

a. Total color difference – not greater than 6 units.
b. Total hue difference – not greater than 2 units.

E. Minor chipping resulting from shipment and delivery is not grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft distance.

F. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.

G. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

2.04 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

B. Minimum reinforcing shall be 0.25 percent of the cross section area.

C. Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1.5 in. of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

D. Panels, soffits and similar stones greater than 24 in. in one direction shall be reinforced in that direction. Units less than 24 in. in both their length and width dimension shall be non-reinforced unless otherwise specified.

E. Welded wire fabric reinforcing shall not be used in dry cast products.

2.05 ACCESSORIES

A. Clips, Plates and Miscellaneous Anchors: ASTM A167, Type 304 stainless steel for items in direct contact with cast stone, unless specifically indicated otherwise.

1. Anchoring Veneer to Miscellaneous Substrates: Stainless steel angles and split-tail anchors.
2. Anchors for Concrete or Concrete Masonry Backup: Stainless Steel with expansion shields.
3. Corners: Stainless Steel cramp anchors for anchoring stones together.

B. Dowels: 1/2-inch diameter, 5 inches long, ASTM A167, Type 304 stainless steel. Provide minimum two dowels per stone or as appropriate to size and configuration of units.

C. Setting Buttons, Shims, and Sheet: Resilient plastic, non-staining, thickness to suit joint thickness and bed depths. For pointed joints, sized to avoid interference with pointing operation.

D. Anchors: ASTM A167, Type 304 stainless steel, sized for conditions, configuration as indicated, with additional attachment devices if recommended by cast stone manufacturer.

1. Anchor Bolts, Nuts and Washers: Type 304 stainless steel dowels.
2. Steel Plates, Shapes and Bars: Type 304 stainless steel.

E. Other Fasteners: Shelf angles and other structural supports shall be galvanized after fabrication in accordance with ASTM A123.

F. Weeps: As furnished or recommended by cast stone manufacturer.

G. Sealants: Vulkem 116, One-part, moisture curing, gun-grade polyurethane sealant.

2.06 FABRICATION

A. Method: Dry Cast; Manufactured from zero slump concrete

1. Vibrant Dry Tamp (VDT) cast method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
2. Machine casting method: Manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.

B. Shapes: Unless otherwise indicated on drawings, provide.

1. Suitable wash on exterior sills, copings, projecting courses and components with exposed top surfaces.
2. Drips on projecting components.

2.07 CURING

A. Cure units in a warm curing chamber approximately 100ºF at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70ºF for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F or 5 days @ 70°F) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

B. Cure cast stone components in presence of carbon monoxide and carbon dioxide to promote carbonation at surface, to minimize efflorescence.

2.08 MANUFACTURES TOLERANCES

A. Minimum Thickness shall be 2.5” to facilitate testing for compressive strength and absorption as specified in ASTM C-1364 Standard Specification for Architectural Cast Stone.

B. Cross section dimensions shall not deviate by more than ±1/8 in. from approved dimensions.

C. Length of units shall not deviate by more than length/ 360 or ±1/8 in., whichever is greater, not to exceed ±1/4 in.

1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

D. Warp, bow or twist of units shall not exceed length/ 360 or ±1/8 in., whichever is greater.

E. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in., on unformed sides of unit, 3/8 in. maximum deviation.

2.09 PRODUCTION QUALITY CONTROL

A. Testing:

1. Test compressive strength and absorption from specimens selected at random from plant production.
2. Samples shall be taken and tested from every 500 cubic feet of product produced.
3. Perform tests in accordance ASTM C 1194 and C 1195.
4. Have tests performed by an independent testing laboratory every six months.
5. New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.
6. Retain copies of all test reports for a minimum of two years.

2.10 DATE STONE

A. Letters and numerals in date stone shall be incised by casting or sandblasting to ½-inch depth from approved full-sized layouts of lettering. Letter and numeric style shall be as specified by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions to receive cast stone components, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone.

B. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units. Notify Architect if construction is not acceptable.

C. Proceed with installations only after unsatisfactory setting conditions have been corrected. Commencement of work constitutes acceptance of existing field conditions.

3.02 INSTALLATION

A. Setting:

1. Drench cast stone components with clear, running water immediately before installation.
2. Do not use pry bars or other equipment in a manner that could damage cast stone components.
3. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
4. Set cast stone components in a full bed of mortar, unless otherwise indicated on the drawings.
5. Fill vertical joints with mortar.
6. Make joints 3/8 inch (9 mm), unless otherwise indicated on the drawings.
7. Leave head joints in copings and similar components with horizontal raked joints for sealant.
8. Rake mortar joints 3/4 in. for pointing.
9. Sponge face of each stone to remove excess mortar immediately after setting.
10. Tool joints to a slight concave profile.
11. Install/set all cast stone components and accessories accurately, using skilled, experienced personnel, according to approved shop and setting drawings, and manufacturer’s printed installation instructions. Use stone-fitters to perform field cutting with power saws, when required. Do not install damaged cast units.
12. Provide chases, reveals, openings and other spaces required to accommodate other work. Close up after other work is complete with cast stone which matches stone already set.
13. Where an open cavity is indicated between cast stone / units and back-up material, keep cavity free of mortar and grout.

14. Install and adjust anchors, supports, fasteners and other attachments indicated or as necessary to secure the stones accurately in locations, with uniform joints, and with edges and faces aligned. Install all cast stonework with anchors, except where only masonry bond is indicated.
15. Install concealed flashing under all copings and at continuous shelf angles, lintels, ledges and similar features.
16. Weepholes - Cavity Wall Construction: Install weepholes above flashing over window heads, relieving angles, through-wall flashing at bottom of wall cavity, etc. as may be shown on the drawings. Ensure weepholes and cavity area above flashing is free of mortar droppings.
17. Install all anchors, supports, fasteners, and other attachments indicated or necessary to secure stonework in place. Attach anchors securely to stone and to supporting surfaces. Place anchors and dowels firmly and fill all holes with mortar or non-shrink grout.

B. Joint Protection:

1. Prime ends of units, insert properly sized foam backing rod and install Vulkem 116 sealant using gun.
2. Provide sealant joints at the following locations and as indicated on drawings: Cast stone components with exposed tops, joints at relieving angles and control/expansion joints.

C. Protect stone while on ground (and after setting) from splashing, mortar, and damage from other trades.

3.03 SETTING TOLERANCES

A. Tolerances shall comply with Cast Stone Institute Standard Specification (latest edition).

1. Variation from Plumb: Do not exceed 1/8 in. in five (5) feet or 1/4 in. in twenty (20) feet or more.
2. Variation from Level: Do not exceed 1/8 in. in five (5) feet, 1/4 in. in twenty (20) feet, or 3/8 in. maximum.
3. Variation in Joint Width: Do not vary joint width more than 1/8 in. or 1/4 of normal joint width, whichever is greater.
4. Variation in Plane Between Adjacent Surfaces: Do not exceed 1/8 in. difference between planes of adjacent components or adjacent surfaces indicated to be flush with components.

3.04 JOINTING

A. Joint size:

1. At stone/brick joints 3/8 in.
2. At stone/stone joints in vertical position 1/4 in. (3/8 in.) optional.
3. Stone/stone joints exposed on top 3/8 in.

B. Joint materials:

1. Mortar, Type N, ASTM C 270.
2. Use a full bed of mortar at all bed joints.
3. Flush vertical joints full with mortar.
4. Leave all joints with exposed tops or under relieving angles open for sealant.
5. Leave head joints in copings and projecting components open for sealant.

C. Location of joints:

1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

3.05 SURFACE REPAIR

A. Repair chipping and other surface damage noticeable when viewed in direct daylight at ten feet.

B. The repairing of cast stone chipped or damaged shall be performed only by mechanics skilled in this work, using matching touch-up materials furnished by the cast stone manufacturer and according to his direction. Stones that cannot be repaired with small patching shall be removed and replaced with new perfect stones at no additional cost to the owner for incurred labor or materials.

C. Repair methods and results to be as recommended by manufacturer approved by Architect.

3.06 FIELD QUALITY CONTROL

A. Inspection: Verify that on-going and completed cast stonework meets specified tolerance and appearance requirements. Remove and replace work that is broken, chipped, stained, or otherwise damaged; work that does not match approved samples or approved mock-up; and work containing defective joints. Inspect finished installation according to Bulletin #36.

B. Replace unacceptable materials using methods and procedures approved by the cast stone manufacturer, which leaves no visible evidence of replacement.

C. Acceptable Appearance: Cast Stone shall show no obvious repairs or imperfections, other than minimal color variations, when viewed with the unaided eye at a 10’ distance in normal daylight conditions.

3.07 CLEANING AND PROTECTION

A. Cleaning: Perform final cleaning as soon as possible after mortar has set and been tooled. Clean faces of stone/unit at pointed joints immediately. Clean stone by wetting with clear running water and applying a solution of "Sure Clean #600" by ProSoCo Products, Inc., or equal. Follow manufacturer's instructions. Remove soiled areas, streaks and stains from pre-finished components using clean water, mild soap, and soft bristle brush. After cleaning, rinse the cast stone/unit and adjacent materials thoroughly with clean water to remove the cleaning solution.

B. Do not use acid solutions, wire brushes, cleaning compounds with caustic or harsh fillers, or other materials or methods which could damage, discolor or etch surfaces or joints, without written approval from cast stone manufacturer.

C. Protection: Protect work from staining or damage to finished surfaces by on-going construction, until acceptance by the Owner.

END OF SECTION

DIVISION 05 – METALS

SECTION 050530 – COLD GALVANIZING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions of Division 01 Specification Sections, apply to work of this section.

B. Cold galvanizing of structural steel members, assemblies, and metal fabrications.

1.02 RELATED SECTIONS

A. Section 051200 – Structural Steel Framing
B. Section 052100 – Steel Joist Framing
C. Section 053000 – Metal Decking
D. Section 054000 – Cold Formed Metal Framing
E. Section 055000 – Metal Fabrications
F. Section 055200 – Metal Railings

1.03 REFERENCES

A. Specification Conformance Data:

1. Federal Specification DOD-P-21035A (formerly MIL-P-21035): Galvanizing Repair Specification
2. Federal Specification MIL-P-26915A (USAF Zinc Dust Primer)
3. Federal Specification TT-P-460 (Type 1, Zinc Dust)

B. Reference Standards:

1. American Society for Testing and Materials (ASTM):

   a. A239 - Locating the Thinnest Spot in a Zinc (Galvanized) Coating in Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
   b. A780 - Repair of Damaged Hot-Dip Galvanizing
   c. B117 - Salt Spray (Fog) Testing)
   d. D520 - Specification for Zinc Dust (Metallic Zinc Powder)
   e. E376 - Measuring Coating Thickness by Magnetic Field or Eddy Current (Electromagnetic) Test Methods

2. Steel Structures Painting Council (SSPC):

   a. SSPC-PS 12.00 - Guide to Zinc-Rich Coating Systems
   b. SSPC Paint 20 - Zinc-Rich Primers, Type II, Organic
   c. SSPC-SP1 - Surface Preparation Specification No. 1 Solvent Cleaning
   d. SSPC-SP3 - Surface Preparation Specification No. 3 Power Tool Cleaning
   e. SSPC-SP6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning
   f. SSPC-SP10 - Surface Preparation Specification No. 10 Near White Blast Cleaning

1.04 DEFINITIONS

A. Cold Galvanizing: A method of applying a zinc coating to structural steel members, assemblies,

and fabrications at ambient temperatures to achieve long-term corrosion protection.

B. Cathodic Protection: Reduction or prevention of corrosion of a metal surface by making it a cathode in an electrolytic cell.

C. Galvanic Action: When two dissimilar metals come into electrical contact with each other in the presence of an electrolyte, the less noble metal (zinc) will sacrifice itself (corrode) to protect the more noble metal (steel, iron, or aluminum).

1.05 SYSTEM DESCRIPTION

A. A metallic zinc coating, containing 95 percent zinc in the dried film that imparts cathodic protection to ferrous and non-ferrous metals through its galvanic action and is recognized by Underwriter's Laboratories, Inc., as an equivalent to commercial hot-dip galvanizing. This coating, in its dry form, is non-toxic and essentially free of such heavy metals as lead, cadmium, barium, antimony, arsenic, chromium, copper, mercury, molybdenum, selenium, silver, and tellurium.

1.06 SUBMITTALS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. Submit manufacturer’s product data, application instructions, and warranty information.

C. Contractor shall furnish the Architect/Engineer with certification that the materials furnished under this specification meet or exceed the requirements herein.

D. Contractor shall furnish the Architect/Engineer with certification that surface preparation of the substrate to be coated has been performed satisfactorily, as herein specified, prior to application of the coating.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Aerosols (12 oz.), half-pints (1.5 lbs.), quarts (6 lbs.), gallons (24 lbs.), or 3.5 gallons (84 lbs.) containers of types suitable to prevent leakage of contents.

B. Acceptance at site: Material shall be accepted at site providing no damage deleterious to products' function is visible and applicable material safety data sheets are present.

C. Storage and Protection: Do not store containers above 104°F. Store containers out of sunlight and away from heat and sparks. Keep containers away from children.

1.08 PROJECT/SITE CONDITIONS

A. Drying time of coating is dependent upon temperature, but product has no application temperature limit.

B. Surface temperature of the substrate to be coated shall be at least 5° above the dew point to avoid possible condensation.

C. Humidity shall be less than 85 percent R.H.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. For the purpose of establishing a level of quality and performance, this specification is based on products manufactured by: Z.R.C. Worldwide, 145 Enterprise Drive, Marshfield, Massachusetts, 02050, (781) 319-0400.

1. Z.R.C. Cold Galvanizing Compound, or equal as approved by the Architect/Engineer.

B. For LEED projects, in lieu of 201.A.1, utilize ZRC Zero-VOC Water-Based Cold Galvanizing Compound.

2.02 MATERIALS

A. Specifications (Based on ZRC Cold Galvanizing Compound):

Type:	Single pack, premixed, ready to apply, U.L. recognized, liquid organic zinc compound.
Finish:	Flat light gray.
Theoretical Coverage:	450 square feet per gallon at 1.5 mil dry film thickness.
Metallic zinc content:	95 percent by weight in dry film.
Flash point:	104°F (SETA method, ASTM D-3278).
Weight per gallon:	24 lbs.
Solids Content:	52%° by volume (ASTM D-2832).
VOC Content:	385 g/l (3.3 lbs./gal.) (ASTM D-1475).
Viscosity:	1,900 cps. - Brookfield spindle No. 6 at 100 RPM at 25°C (ASTM D-2196).
Maximum service temperature:	750°F (ASTM D-2485).
Specific gravity:	2.797 (ASTM D-1963).
Electrical Conductivity:	73 million ohms per 3 mil dry (resistivity).
Impact resistance:	Greater than 30-inch lbs. (extrusion per ASTM D-2794).
Abrasion resistance:	11.5 liters per dry mil (tested at 3 dry mils per ASTM D-968).
Pot life:	At least 24 hours.
Shelf life:	Bulk type, 3 years minimum; aerosol type, 1 year minimum.
Dry time:	(Set to touch) When ambient air-dried, 20-30 minutes (ASTM D-1640).
Recoat time:	(Second coat) After 12 hours. Under certain conditions, recoat time can be reduced. Please contact manufacturer for specifics.

B. Substrates acceptable for coating.

1. Substrates shall be of iron, steel, or aluminum including structural shapes, pipe, sheet, fabrications, and assemblies.

2. Substrates of iron, steel, or aluminum may be satisfactorily coated regardless of carbon, phosphorus, manganese, or silicon inclusion.

2.03 EQUIPMENT

A. Coating shall be applied by brush, roller, low pressure compressor-type spray or airless-type spray.

B. Refer to Section 3.03 B for specific equipment information.

2.04 MIXES

A. Coating herein specified is a one-component, premixed, ready to apply compound.

B. Contents of containers shall be stirred well upon opening and during application to ensure homogeneous mix.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Iron, steel, or aluminum surfaces to be coated shall be clean; i.e., devoid of grease, oil, mill scale, oxidation, loosely adherent rust, paint, etc.

B. Coating shall be applied directly to metal surface to be galvanically active.

3.02 PREPARATION

A. Surface preparation is dependent upon substrate condition and intended service. Preparation shall be in accordance with manufacturer’s requirements for substrate to be coated.

B. Typical examples are as follows:

Grease and oils:	Solvent clean to SSPC-SP1
Rust scale or easy to remove paint:	Power tool clean to SSPC-SP3
Mill scale or firmly adhered paint:	Sandblast to SSPC-SP6 (commercial)
Water immersion:	(100°F maximum) Sandblast to SSPC-SP10 (near-white)

3.03 APPLICATION

A. General Application Information:

1. The coating shall be applied at sufficient wet film thickness to achieve a minimum dry film build of 2.5-3.5 mils, using manufacturer's recoat time directions.

2. The coating has good brushing properties and is suitable for spray application, when such application is specified.

3. Thinning with appropriate thinners as recommended by the manufacturer is allowed provided film thickness requirements can be maintained and other properties of the coating remain uncompromised.

4. The coating shall be well stirred before use so that it is completely homogeneous during application.

5. Continuous agitation (by means of an in-pot power mixer) is strongly recommended to ensure the continuous application of a completely homogeneous material at all times.

6. Omit coating of surfaces to be welded in the field. Coat in the field after welding to obtain uniformity and equal protection with adjacent surfaces.

7. Material partially used at the end of any day shall be protected from skinning by placing thick blanket of solvent over remaining coating followed by careful closing of containers. Coating may be reused on the following day after total rehomogenization.

B. Specific Application Information:

1. Application by brush or roller: Apply as received in container. For Brush application, its recommended only 100% Natural Chinese bristle brushes. For Roller Application, its recommended rollers with a 3/8” nap, made of mohair or lambs wool (sheepskin).

2. Application by low pressure compressor type spray:

Atomized air pressure:	50 lbs.
Fluid pressure:	15-20 lbs.
Orifice of tip:	80/100ths (.080)
Viscosity reduction:	4 parts Coating to 1 part mineral spirits solvent, or 16 parts Coating to 1 part Xylene

3. Application by airless type spray:

Pump:	30:1
Hose:	1/2" (I.D.) Airless type
Orifice of tip:	600 - 26/1000 ths. (.026)
Type of tip:	Tungsten carbide, reversing (self-cleaning)
Filter screens:	Complete removal is recommended. If screens are employed, use no less than 30 mesh.
Viscosity:	No reduction required.
Recommended procedure:	Connect hose directly to pump without filter assembly, ensuring a hose length of 50 feet maximum. Use least pressure possible. Start at 1,500 lbs. and increase as required for good spraying properties.

C. Clean Up: Use mineral spirits solvent or Xylene.

3.04 FIELD QUALITY CONTROL

A. Inspect installed galvanized materials, fabrications, and assemblies for coating thickness in accordance with ASTM E-376.

3.05 ADJUSTING

A. After erection, on all uncoated areas, prepare and apply coating as per Section 3.03 above.

B. Touch up any areas where shop coat has been damaged in accordance with ASTM A-780.

3.06 PROTECTION

A. After 24-48 hours, cold galvanizing coating can be painted/coated with acrylic, chlorinated rubber, epoxy, urethane, or vinyl type products if painting is specified in the Contract Documents.

B. Do not top-coat with alkyd or lacquer type products.

END OF SECTION

DIVISION 05 – METALS

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section. This Section includes the following: structural steel, grout.

1.02 SUMMARY

A. Extent of structural steel work is shown on drawings, including schedules, notes, and details to show size and location of members, typical connections, and type of steel required.

B. Structural steel is that work defined in American Institute of Steel Construction (AISC) *"Code of Standard Practice",* and as otherwise shown on drawings.

C. Miscellaneous metal fabrications are specified elsewhere in Division 05. Refer to Division 03 for anchor bolt installation in concrete; Division 04 for masonry.

D. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and test will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1. Promptly remove and replace materials or fabricated components which do not comply.

E. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work. Contractor shall retain the services of a licensed professional engineer for the design of any connections not shown on the drawings.

1. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

F. Related Sections include the following:

1. Section 053000 – Metal Decking; for field installation of shear connectors.

2. Section 055000 – Metal Fabrications; for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel, including, but not limited to, loose steel bearing plates for structural steel and miscellaneous steel shapes for framing deck openings.

1.03 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents

to be selected or completed by the fabricator to withstand design loadings indicated.

B. Connections: Provide details of connections to withstand loads and other design criteria indicated and to comply with other information and restrictions indicated.

1. Steel fabricator shall detail connections using sections, details, typical details, and other requirements indicated on the structural drawings and using the schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4 to resist loads and other design criteria specified on the structural drawings.

C. Construction: Type 2, simple framing.

D. Engineering Responsibility: Under Base Bid submitted, the Prime Contractor shall engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.05 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

2. High-strength bolts (each type), including nuts and washers.

3. Structural steel primer paint.

4. Shrink-resistant grout.

C. Shop Drawings: Submit shop drawings prepared under the supervision of a registered professional engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams. Show fabrication of all structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Indicate type, size and length of bolts, distinguishing between shop and field bolts.

2. Provide setting drawings, templates, and directions, for installation of anchor bolts and other anchorages to be installed as work of other sections.

3. Include embedment drawings.

4. Include welding certificates.

5. Include shop drawings signed and sealed by a qualified professional engineer responsible for their preparation.

6. Qualification Data: For installer, fabricator, Professional Engineer, and testing agency.

7. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

a. Structural steel, including chemical and physical properties.
b. Bolts, nuts and washers, including mechanical properties and chemical analysis.
c. Direct-tension indicators.
d. Tension-control, high-strength bolt-nut-washer assemblies.
e. Shear stud connectors.
f. Shop primers.
g. Non-shrink grout.

1. Include source quality-control test reports.

D. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

E. Surveys: Submit certified copies of each survey conducted by a registered Professional Engineer or land surveyor, showing elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and contract documents.

1.06 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:

1. AISC "*Code of Standard Practice for Steel Buildings and Bridges*."

a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."

2. AISC *"Seismic Provisions for Structural Steel Buildings"*

3. AISC *"Specifications for the Design, Fabrications, and Erection of Structural Steel for Buildings,"* including "Commentary" and Supplements thereto as issued.

4. AISC *"Specifications for Architecturally Exposed Structural Steel."*

5. AISC *"Specifications for Structural Joints using ASTM A325 or A490 Bolts"* approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

6. AISC *"Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design".*

7. AISC *"Specification for the Design of Steel Hollow Structural Sections".*

8. AISC *"Specification for Allowable Stress Design of Single-Angle Members".*

9. American Welding Society (AWS) D1.1 *"Structural Welding Code - Steel."*

10. ASTM A6 "*General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."*

11. Research Council on Structural Connections' (RCSC) *"Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."*

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance

with AWS D1.1, *"Structural Welding Code – Steel."*

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

2. If re-certification of welders is required, retesting will be Contractor's responsibility.

C. Installer's Qualifications: A qualified installer who is familiar with and performs work in accordance with AISC's *"Code of Standard Practice for Steel Buildings and Bridges"* and *"Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design"* and OSHA's Steel Erection Standard and who has successfully completed projects of similar size and complexity.

D. Fabricator's Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:

a. Category: Complex steel building structures.

b. Fabricator shall be registered with and approved by authorities having jurisdiction.

E. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports and spacers. Protect steel members and packaged materials from corrosion or deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

2. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.

1.08 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Surfaces, General: For fabrications of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale, seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes.

B. Structural Steel Shapes, Plates, and Bars: ASTM A992/A572-50. minimum F_y = 50 ksi.

C. Channels and Angles, Plates and Bars: ASTM A 36, minimum F_y = 36 ksi.

D. Cold-Formed Steel Tubing / Hollow Structural Sections (HSS): ASTM A500, Grade B; minimum F_y = 46 ksi, structural tubing.

E. Hot-Formed Steel Tubing: ASTM A501.

F. Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.

G. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finished carbon steel; with dimensions headed-stud type, cold-finished carbon steel; Type B, complying with AWS D1.1 requirements.

H. Anchor Bolts: ASTM F 1554, Grade 36; non-headed type unless otherwise indicated.

1. Configuration: As shown in contract documents.
2. Nuts: ASTM A 563 heavy hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain typical, except hot-dip zinc coating, ASTM A 153, Class C for galvanized members.

I. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

    a. Finish: Plain typical, except hot-dip zinc coating, ASTM A 153, Class C for galvanized members.

2. Quenched and tempered alloy steel bolts, nuts, and washers, complying with ASTM A490.

    a. Direct tension indicator washers may be used at Contractor's option.

J. Electrodes for Welding: Comply with AWS Code requirements, E70XX minimum.

K. Primer:

1. Primer for steel not exposed to weather or exterior conditions: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

2. Primer for exterior exposed steel:

a. Prime coat: Tnemec series 90-97 zinc-rich aromatic urethane primer.
b. Intermediate coat: Tnemec series 66 polyamide epoxy coating.

L. Loose and Hung Lintel Steel Primer Paint: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer, similar or equal to: 50-330 Poly-Ura-Prime by Tnemec Co., Inc.

2. Lintel angles for exterior veneer, either loose or hung, shall be hot dip galvanized. Final painting shall be after installation, but prior to installation of items in masonry openings.

M. Galvanizing Repair Paint: Comply with Fed. Spec. SSPC-Paint 20.

N. Non-metallic Shrinkage-resistant Grout: Factory-packaged, pre-mixed, non-metallic, non-corrosive, non-staining aggregate grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621 and ASTM C1107. Mixed with water to consistency suitable for application and a 30-minute working time.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

a. Euco N.S.; Euclid Chemical Company.
b. Crystex; L & M Construction Chemicals.
c. Masterflow 713; Master Builders.
d. Five Star Grout; U.S. Grout Corporation.
e. Upcon; Upco Chemical Division, USM Corporation.
f. Propak; Protex Industries, Inc.
g. Set Non-Shrink; Set Products, Inc.

O. Combined post-consumer and post-industrial recycled content of all structural steel components must be at least 90%, electric arc furnace steel.

2.02 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC's *"Code of Standard Practice for Steel Buildings and Bridges"* and AISC's *"Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."* and as indicated on final shop drawings. Provide camber in structural members where indicated.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected. Mark and match-mark materials for field assembly.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded connections or other connections are indicated.

1. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

2. Provide unfinished threaded fasteners for only bolted connections of secondary framing

members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.

C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with RCSC's *"Specifications for Structural Joints using ASTM A325 or A490 Bolts"* for type of bolt and type of joint specified or required.

D. Welded Construction: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance and quality of welds, and for methods used in correcting welding work.

1. Assemble and weld built-up sections by methods which will produce and maintain true alignment of axes without warp and without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with AWS D1.1 and manufacturer's written instructions.

F. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

G. Holes for Other Work: Provide holes as required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings. Holes not indicated on structural drawing are not permitted without written approval from the Structural Engineer.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not thermally cut holes or enlarge holes by burning. Drill holes in bearing plates.

3. Base-Plate Holes: Cut, drill or punch holes perpendicular to steel surfaces.

4. Weld threaded nuts to framing and other specialty items indicated to receive other work.

H. Expansion Joints: Provide expansion joints in steel shelf angles when part of structural steel frame; locate at vertical brick expansion joints as indicated on drawings.

I. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

J. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

2.03 SHOP PAINTING

A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only. Accurately finish ends of columns and other members transmitting bearing loads.

1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.

2. Do not paint surfaces which are scheduled to receive sprayed-on fireproofing.

3. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

B. Surface Preparation: After inspection and before shipping, clean steel surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with one of the approved Steel Structures Painting Council (SSPC) methods as follows:

1. SP-1 "Solvent Cleaning."
2. SP-2 "Hand Tool Cleaning."
3. SP-3 "Power Tool Cleaning."
4. SP-5 "White Metal Blast Cleaning."
5. SP-6 "Commercial Blast Cleaning."
6. SP-7 "Brush-Off Blast Cleaning."
7. SP-10 "Near-White Blast Cleaning."

C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's written instructions and at a rate recommended by SSPC to provide dry film thickness of not less than 1.5 mils. Use painting Paint System Guide No. 7.00, and priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Provide a one-coat shop applied paint system complying with Steel Structures Painting Council (SSPC), methods which result in full coverage of joints, corners, edges, and exposed surfaces.

2.04 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.

1. Fill vent holes and grind smooth after galvanizing.

2. Galvanize lintels, shelf angles, beams and all other steel members located in exterior walls supporting and/or in contact with masonry veneer and/or masonry back-up.

2.05 SOURCE QUALITY CONTROL

A. Contractor will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's *"Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."*

D. Welded Connections: In addition to visual inspection required for every weld, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Ultrasonic Inspection: ASTM E 164.
2. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

F. Extent of Inspection and Testing:

1. Bolted Connections:

a. 100 percent of shop-bolted connections shall be visually inspected.

2. Welded Connections:

a. 40 percent of shop-welded connections shall be visually inspected.

b. 100 percent of partial penetration and full penetration type shop welded connections shall be tested by ultrasonic or radiographic inspection.

c. All welds suspected of being defective based on visual inspection shall be tested by ultrasonic or radiographic inspection.

3. Shear Connectors:

a. 100 percent welded shear connectors shall be visually inspected.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify elevations of concrete and masonry bearing surfaces and locations of anchor rods/bolts, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION

A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Set structural steel accurately in locations and to elevations indicated and according to AISC's *"Code of Standard Practice for Steel Buildings and Bridges" and "Specification*

for Structural Steel Buildings--Allowable Stress Design and Plastic Design." Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads, as required. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces, prior to setting base, bearing and leveling plates. Clean bottom surface of base, bearing and leveling plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges, shims, setting/leveling nuts or other adjusting devices as required and adjust column base leveling nuts as required.

a. Snug-tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

b. Pack grout solidly between bearing surfaces and base or bearing plates to ensure that no voids remain. Neatly finish exposed surfaces, protect installed materials and grout, and allow to cure.

c. For proprietary grout materials, comply with manufacturer's written instructions for shrinkage-resistant grouts.

E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure within specified AISC tolerances.

2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at time of erection and mean temperature at which structure will be when completed and in service.

3. Splice members only where indicated and accepted on shop drawings and as required to meet OSHA's Steel Erection Standards.

4. Do not use thermal cutting during erection.

5. Maintain erection tolerances of structural steel within AISC's *"Code of Standard Practice for Steel Buildings and Bridges."*

F. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

    a. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

G. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

H. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

    1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

I. Touch-up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint on structural steel is included in Division 9 under painting work.

3.04 FIELD CONNECTIONS

A. High Strength Bolts: Install high-strength bolts according to RCSC's *"Specification for Structural Joints Using ASTM A 325 or A 490 Bolts"* for type of bolt and type of joint specified.
    1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

    1. Comply with AISC's *"Code of Standard Practice for Steel Buildings and Bridges"* and *"Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design"* for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

    2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's *"Code of Standard Practice for Steel Buildings and Bridges"* for mill material.

3.05 FIELD QUALITY CONTROL:

A. The Contractor shall make arrangement for and the Owner shall pay for an independent testing and inspection agency to inspect and test high-strength bolted connections and welded connections, to perform tests and prepare test reports, in conformance with all Special Inspection requirements. The Contractor will be responsible for all costs associated with failed tests.

    1. Testing agency shall conduct and interpret tests, and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

    2. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

    3. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

    4. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's

expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

B. Shop Bolted Connections: Inspect or test in accordance with AISC specifications.

C. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. Perform visual inspection of all welds.

3. Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option:

a. Liquid Penetrant Inspection: ASTM E165.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

c. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."

d. Ultrasonic Inspection: ASTM E164.

D. Field Bolted Connections: Inspect in accordance with RCSC's *"Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."*

E. Field Welding: Field welds will be visually inspected according to AWS D1.1, ***and in accordance with Chapter 17 requirements of the NYS Building Code***. Inspect and test during erection of structural steel as follows:

1. Verify certification of welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. Perform visual inspection of all welds.

3. The testing agency shall perform tests of welds as follows:

a. Liquid Penetrant Inspection: ASTM E165.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

c. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."

d. Ultrasonic Inspection: ASTM E164.

4. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

5. Extent of Inspection and Testing:

1. Bolted Connections:

a. 100% of field-bolted connections shall be visually inspected.

2. Welded Connections:

a. 100% of field-welded connections shall be visually inspected.

b. 100% of partial penetration and full penetration type field-welded connections shall be tested by ultrasonic or radiographic inspection.

c. 100% of any weld suspected of being defective based on visual inspection shall be tested by ultrasonic or radiographic inspection.

6. Shear Connectors:

a. 100% of field-welded shear connectors shall be visually inspected.

b. Any shear connector suspected of being defective based on visual inspection shall be tested by bend test.

c. Additional 10% minimum of total number of shear connectors shall be tested by bend test if weld fracture occurs on shear connectors already tested.

F. Installation of hangers and supports on structural components by Mechanical Contractor and/or Plumbing Contractor.

1. Structural steel (wide flange and standard beams, channels):

a. Mechanical Contractor and/or Plumbing Contractor to install individual supports/hangers and trapezes off center of structural steel component.

2. Light gauge metal trusses:

a. Mechanical Contractor and/or Plumbing Contractor to install individual support/hangers and trapezes only at panel points. The Mechanical Contractor and/or Plumbing Contractor shall reimburse the General Contractor (who is supplying the trusses) to provide reinforcing per manufacturers recommendations. ***If work is in an existing structure, no panel point deviation will be permitted and the Mechanical Contractor provides hanging/support details showing reinforcement of existing structural components designed, signed and sealed by an Engineer licensed in the State of New York.***

3.06 REPAIRS AND PROTECTION:

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural steel and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION

DIVISION 05 – METALS

SECTION 052100 – STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 SUMMARY

A. Extent of steel joists and joist girders is shown on drawings, including basic layout and type of joists required.

B. This Section includes the following:
   1. K-Series Steel Joists
   2. LH-Series Long-span Steel Joists
   3. Joist Girders
   4. Joist Accessories

1.03 RELATED SECTIONS

A. Section 051200 – Structural Steel Framing
B. Section 053000 – Metal Decking
C. Section 055000 – Metal Fabrications

1.04 REFERENCES

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.

C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

E. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts

F. ASTM B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

G. ASTM F 436 - Standard Specification for Hardened Steel Washers

H. AWS D1.1 - Structural Welding Code – Steel

I. Steel Joist Institute (SJI) - Standard Specifications, Load Tables & Weight Tables for Steel Joists and Joist Girders.

J. SJI - Code of Standard Practice

1.05 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.06 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications."

C. Shop Drawings: Submit detailed drawings showing layout of joist units, special connections, joining, and accessories.

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.
4. Provide templates or location drawings for installation of anchor bolts and metal bearing plates.

D. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Certification: Submit evidence of SJI membership and that joists and joist girders have been designed in accordance with SJI requirements.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member of the Steel Joist Institute who regularly produces steel joists of the K, LH, or DLH Series, or joist girders conforming to SJI's Specifications and Load Tables and whose designs have been checked and accepted by the Steel Joist Institute.

B. Provide joists fabricated in compliance with the following, and as herein specified.

1. Steel Joist Institute (SJI) "Standard Specifications, Load Tables, and Weight Tables" for:

a. K-Series Open Web Steel Joists.
b. LH-series Long-Span Steel Joists
c. Steel joist accessories

C. Design connections under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

D. Qualification of Field Welding: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Inspection: Inspect joists and girders in accordance with SJI specifications.

F. Performance Test: If required, conduct performance tests in accordance with procedures

described in SJI "Recommended Code of Standard Practice."

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel joists as recommended in SJI "Specifications."

B. Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

C. Do not store joists directly on the ground.

D. Store materials in a manner which will permit easy access for inspection and identification.

E. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.09 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide Steel Joists in conformance with SJI - Standard Specifications, Load Tables & Weight Tables for Steel Joists and Joist Girders.

B. Open Web Joists Members: SJI Type

1. Open Web Steel Joists (K Series).
2. Longspan Steel Joists (LH Series).
3. Deep Longspan Steel Joists (DLH Series).
4. Joist Girders.
5. Composite Joist (CJ Series).

C. Bridging: Provide bridging of material, size, and type required by SJI Standard Specifications for type of joist, chord size, spacing, and span.

D. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc coating, ASTMA153/A153M, Class C.
3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc coating, ASTMA153/A153M, Class C.
3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

G. Field Welding in accordance with AWS and SJI.

H. Steel Prime Paint: Comply with SJI "Specifications" and see Section 051200, "Structural Steel".

I. Bedding Mortar: For joist ends bearing on concrete or masonry, provide bedding mortar as follows:

1. Non-metallic shrinkage-resistant mortar; premixed, non-corrosive, non-staining product containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

2. Products: Provide non-metallic, shrinkage resistant mortar as manufactured by one of the following:

a. Euco N.S.; Euclid Chemical Co.
b. Crystex; L & M Construction Chemicals.
c. Masterflow 713; Master Builders.
d. Five Star Grout; U.S. Grout Corp.
e. Upcon; Upco Chem. Div., USM Corp.
f. Propak; Protex Industries, Inc.

2.02 FABRICATION

A. General: Fabricate steel joists in accordance with SJI "Specification."

B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

C. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.

D. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1" of finished wall surface unless otherwise indicated.

E. Camber joists according to SJI Standard Specifications.

F. Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with SJI "Specifications."

1. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

G. End Anchorage: Provide end anchorages including bearing plates, to secure joists to adjacent construction, complying with SJI "Specifications," unless otherwise indicated.

H. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

I. Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.

1. Apply one shop coat of steel prime paint to joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Place and secure steel joists in accordance with SJI "Specifications," final shop drawings, and as herein specified.

1. Anchors: Furnish anchor bolts, bearing plates, and other devices to be built into concrete and masonry construction.

    b. Provide unfinished threaded fasteners for anchor bolts, unless otherwise indicated.

    c. Refer to Division 03 sections for installation of anchors set in concrete.

    d. Refer to Division 04 sections for installation of anchors set in masonry.

2. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

    a. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.

    b. Where "open web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.

    c. Align and adjust joists and joist girders accurately before fastening. Tolerances shall conform with AISC Code of Standard Practice for Steel Buildings and Bridges. Fastening of splices of compression members shall be performed after the abutting surfaces have been brought into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. Splices will be permitted only where indicated.

    d. Set joists and joist girders accurately at the established lines and levels. Joists and joist girders shall be plumb and level (with indicated allowance for camber) before bolting is commenced. Temporary bracing shall be provided as required and shall be kept in position until completion of erection, anchorage, and bridging installation.

3. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

    a. Install horizontal bridging for top and bottom chords as indicated and in accordance with the SJI Standard Specifications and Code of Standard Practice.

4. Fastening Joists:

    a. Field weld joists to supporting steel framework in accordance with SJI "Specifications" for

type of joists used. Coordinate welding sequence and procedure with placing of joists.

b. Secure joists resting on masonry or concrete bearing surfaces by bedding in mortar and anchoring to masonry or concrete construction as specified in SJI "Specifications" for type of steel joist used.

c. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.

1) Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown. Install in accordance with AISC "Specifications for Structural Joints Using ASTM A 325 or A490 Bolts."

2) Touch-Up Painting: After joist installation, paint field bolt heads and nuts, welded areas, and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

B. Frame openings greater than 18 inches with supplementary framing.

C. Do not permit erection of decking until joists are properly bridged and secured.

D. Installation of hangers and supports on structural components by Mechanical Contractor and/or Plumbing Contractor.

1. Structural steel (wide flange and standard beams, channels):

a. Mechanical Contractor and/or Plumbing Contractor to install individual supports/hangers and trapezes off center of structural steel component.

2. Steel Joists:

a. Mechanical Contractor and/or Plumbing Contractor to install individual supports/hangers and trapezes only at panel points. If point of attachment is more than 1-1/2” laterally off panel point the Mechanical Contractor and/or Plumbing Contractor shall reimburse the General Contractor (who is supplying the joists) to provide reinforcing per steel joist manufacturers recommendations. If work is in an existing structure, no panel point deviation will be permitted, unless the Division 15 Contractor provides hanging/support details showing reinforcement of existing structural components designed, signed and sealed by an Engineer licensed in the State of New York.

3. Light gauge metal trusses:

a. Mechanical Contractor and/or Plumbing Contractor to install individual support/hangers and trapezes only at panel points. The Mechanical Contractor and/or Plumbing Contractor shall reimburse the General Contractor (who is supplying the trusses) to provide reinforcing per manufacturers recommendations. If work is in an existing structure, no panel point deviation will be permitted and the Division 15 Contractor provides hanging/support details showing reinforcement of existing structural components designed, signed and sealed by an Engineer licensed in the State of New York.

E. Do not field cut or alter structural members without approval of Architect/Engineer and the Joist Fabricator.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E165/E165M.
b. Magnetic Particle Inspection: ASTM E709.
c. Ultrasonic Testing: ASTM E164.
d. Radiographic Testing: ASTM E94.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION

DIVISION 05 – METALS

SECTION 053000 – METAL DECKING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish material, labor, equipment, services necessary to erect all metal deck, including connections, welding and accessories required for installation of Work. Field cut and fit deck as required and cut all openings.

B. Place edge of deck at proper location to ensure proper placement of masonry. Set deck edge from a survey line based on the theoretical building line.

1.02 RELATED SECTIONS

A. Section 051200 – Structural Steel Framing
B. Section 052100 – Steel Joist Framing
C. Section 055000 – Metal Fabrications
D. Section 078100 – Spray-Applied Fire Resistive Materials

1.03 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work**.**

A. American Society Testing and Materials (ASTM) standards, latest editions.

1. A29 - Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for

2. A36 - Standard Specification for Carbon Structural Steel.

3. A108 - Standard Specification for Steel Bars, Carbon, Cold-finished, Standard Quality.

4. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

5. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coating.

6. A992 - Standard Specification for Steel for Structural Shapes for Use in Building Framing

7. B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

B. "Specification for Structural Steel Buildings” - American Institute of Steel Constructor's (AISC 360-05).

C. “Seismic Provisions for Structural Steel Buildings” (AISC 341-05).

D. “Structural Design of Composite Slabs” – American Society of Civil Engineers (ASCE 3-91).

E. “Standard for Noncomposite Steel Floor Deck” - Steel Deck Institute (ANSI/NC 1.0-06)

F. “Standard for Steel Floor Deck” – Steel Deck Institute (ANSI/RD 1.0-06).

G. Safety Requirements for Powder-Actuated Fastening Systems (ANSI A10.3), American National Standard (ANSI).

H. International Code Council Evaluation Service (ICC-ES):

1. International Building Code

2. Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43)

3. Steel Deck Diaphragms (ESR-2199)

I. "Structural Welding Code - AWS D1.1" - American Welding Society (AWS).

J. "Specifications for Mild Steel Covered Arc - Welding Electrodes - AWS A5.1" - AWS.

K. "Diaphragm Design Manual for Floor Decks and Roof Decks" 3rd Edition - Steel Deck Institute (SDI).

L. "Fire Resistance Directory" - Underwriters Laboratory (UL).

1.04 DESIGN REQUIREMENTS

A. Design of metal deck is governed by Chapter 22 of the 2020 NYS Building Code. Structural integrity requirements of the BC shall be met.

B. Metal deck unit sizes and gages are indicated on the Drawings.

C. Units shall be of three-span length except where framing layout does not permit. Deck sheets shall be butted over supports.

D. Provide shoring where required by the deck manufacturer as indicated on the approved shop drawings and where indicated on the Contract Documents.

E. Use of integral and non-piercing hanger tabs to support ceiling systems is not permitted. Piercing hanger tabs with a safe working loading of 250 lbs or greater are permitted for ceilings weights below the hanger tab capacity. Integral hanger tabs are to be used for venting purposes only.

F. Units included in a fire rated assembly must be classified in appropriate UL designs or have MEA, BSA, or OTCR approval.

G. Use fasteners or welds for decking attachment that provide adequate diaphragm shear strength, uplift resistance and stiffness for imposed load combinations.

H. Performance Requirements: FM classified Class I-90 minimum for uplift resistance and UL fire classified for roof deck.

1.05 SUBMITTALS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. Product Data:

1. Submit manufacturer's specifications for

a. Shear stud connectors
b. Deck Fasteners, if used
c. Primer Paint

C. Shop Drawings:

1. Prepare metal deck shop drawings immediately after award of Contract.

2. Shop drawings shall include, but not be limited to the following:

a. Type and gage of metal deck.
b. Metal deck layout and orientation, including clear indication where shoring is required.
c. Welding or fastener types, sizes and pattern.
d. Side and end details of metal deck.
e. Supplementary framing details.
f. Location of all openings and fittings.
g. Shop finish.
h. Size, location, and spacing of stud shear connectors, where required, for each beam.
i. Designation of welding electrode strength to be used.

D. Shop drawings reviewed by the Engineer of Record for general conformity with the Drawings shall not relieve the Contractor or the metal deck supplier of responsibility for correctness of fit, quantities of materials, and adequacy of attachment details of deck and accessories to the structural steel. Deck must have UL or OTCR approval as part of the fire rated assembly. Approval of shop drawings does not absolve the Contractor of this requirement.

E. Calculations in accordance with ICC-ES AC 43 or SDI Design Method verifying diaphragm shear strength and stiffness: Submit calculations for the load tables of the metal deck supplied. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of New York.

F. Quality Control Submittals:

1. Certificates

a. Submit notarized certificates from the manufacturers of the specified materials stating compliance with the applicable requirements set forth for all materials specified in this Section.

b. Furnish steel manufacturer's certificate certifying welders employed on the Work have met AWS qualifications within the previous twelve months, and for work performed in the field are licensed welders.

c. Furnish proof that deck to be used is part of a UL, MEA, BSA, or OTCR approved fire-rated assembly if other than deck shown on Drawings.

d. Submit certificate stating deck manufacturer is a member producer of SDI.

2. Manufacturers' Instructions: Furnish manufacturers' printed material, specifications and installation instructions for each type of decking, accessories, and studs.

3. Contractor Qualifications

G. Provide proof of Manufacturer, Erector, welder, and mechanical fastener technician qualifications specified under “Quality Assurance”.

H. Surveys:

1. Submit signed and sealed copies of surveys conducted by a Licensed Land Surveyor showing locations of edge of deck with respect to theoretical edge of deck and building survey line.

1.06 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Company specializing in the manufacture of metal deck as used in this Contract shall have a minimum of five years experience and is a member producer of SDI.

2. Erector: Company specializing in performing the Work of this Section shall have a minimum of three years experience and have done at least three projects with similar quantity of material.

3. Welders: All steel roof deck welders shall be AWS certified for welding of sheet steel.

4. Mechanical Fastener Installer: Shall be certified or licensed by the fastener and tool system manufacturer on the project site in accordance with ANSI A10.3 requirements. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYS Building Code and all applicable regulations of other governmental authorities. Where more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.

2. Industry Standards: Standards specified herein shall apply to Work of this Section. Where more severe requirements then those contained in the standards are given in this section or the Building Code, requirements of this Section or the Building Code shall govern.

a. AISC 360-05 as modified by the 2020 NYS Building Code.

b. Seismic Provisions for Structural Steel Buildings AISC 341-05.

c. 2020 NYS Building Code

d. Fire Resistance Directory - UL.

1) Composite metal deck shall have UL approval with respect to the following:

2. As a component part of a floor construction of specified fire resistance rating without need for sprayed fireproofing on underside of deck.

3. As a component part of a three-hour fire resistive floor construction with use of sprayed fireproofing on underside of deck.

1) Roof deck shall have UL approval as a component part of the specified fire resistive roof construction.

2) Recommendations or suggestions in the codes and references listed in this Article and under “References” shall be deemed to be mandatory unless they are in violation of the Building Code.

B. Certifications

1. Structural metal deck and stud shear connectors shall conform to the material acceptance, certification and inspection requirements of the BC.

2. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver deck to site undamaged. With each deck unit bearing the UL label and marking for specific system detailed.

B. Store deck units off the ground with one end elevated to provide drainage. Protect units from the elements with a waterproof covering.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Metal Deck and Accessories

1. CANAM Steel Corporation
2. Wheeling Corrugating Co.
3. Nucor, Vulcraft Group

B. Stud Shear Connectors

1. Nelson Stud Welding Co.
2. Tru-Weld/Tru-Fit Products Corporation
3. Hilti, Inc.

C. Mechanical Fasteners

1. Hilti, Inc.
2. ITW Buildex

D. Sidelap Connectors

1. Hilti, Inc.
2. ITW Buildex
3. Elco Textron

2.02 MATERIALS

A. Steel for Composite Metal Deck:

1. Formed from galvanic steel sheets conforming to ASTM A653. Size of deck is to follow SDI requirements for thickness and tolerances.

2. Minimum yield strength of 40,000 psi.

3. Formed with integral locking lugs.

4. Formed with deformations to provide bond with concrete.

5. Deck to receive sprayed fireproofing shall be free of lubricants or oils that would impair the adhesion of the fireproofing material.

6. Metal deck that is not exposed to view with architectural paint finish shall have integral hanger tabs providing an approximate 0.5% uniformly distributed open area. The hanger tabs are used for venting purposes only.

B. Steel for Roof Deck:

1. Formed from galvanic steel sheets conforming to ASTM A653. Size of deck is to follow SDI requirements for thickness and tolerances.

2. Minimum yield point of 40,000 psi.

3. Deck to receive sprayed fireproofing shall be free of lubricants or oils that would impair the adhesion of the fireproofing material.

C. Acoustical Cellular Roof Deck:

1. Cellular Deck and Metal Accessories: Sheet steel conforming to ASTM A 611 Grade C or ASTM A 446 Grade A. Before fabrication, sheet steel shall receive ASTM A653, Class G 90, hot dip zinc coating. Accessories shall be fabricated of not lighter than 18 U.S. Standard Gauge sheet steel.

   a. Deck for Composite Construction: Galvanized deck uniformly deformed to insure a mechanical bond between concrete and steel. Metal accessories shall be galvanized.

2. Acoustical Deck: Cellular deck with bottom flat plate perforated directly below each cell and with deck manufacturer's standard sound absorbing elements consisting of an inert, non-organic, mineral fiber material which will produce a Noise Reduction Coefficient (NRC) of 0.70.

3. Self-Drilling Fasteners: No. 12-14 x 3/4 inch, hex washer head, self-drilling fastener with pilot point.

4. Cellular steel deck units shall be formed to provide smooth, completely enclosed raceways conforming to UL requirements. Deck units shall be carefully cut to required lengths at the factory within UL tolerances for length and squareness, to insure proper abutting of units at the site.

   a. Length: Furnish units of continuous length over 3 spans wherever possible.

   b. For steel deck properties and depth see contract drawings.

5. For cellular units, the ratio of distance between stiffened edges to metal thickness of any top horizontal surface shall not exceed 120.

6. Deck units shall have a continuous reinforcing web between top and bottom cell elements where cells are cut longitudinally 1-1/2 inches or more away from the vertical web.

7. Erect cellular steel deck and accessories under the direct supervision of the manufacturer's field advisor.

D. Miscellaneous Steel Shapes:

1. Shall conform to the requirements of ASTM A36 or A992. Members to receive sprayed

fireproofing shall be unprimed and free of lubricants or oils that would impair the adhesion of the fireproofing material.

E. Shop Finish:

1. Metal deck: Steel sheet shall receive before being formed a coating of zinc conforming to ASTM A653 coating class G60 (both sides). Metal deck exposed to view, such as in the gymnasium, shall be cleaned and phosphatized prior to priming. Primer shall be applied in the shop and shall be structural steel primer paint applied at a rate of 0.6 Mils DFT minimum). Salt spray resistance of paint shall be 100+ hours when tested in accordance with ASTM B117.

2. Steel roof deck: Steel sheet shall receive before being formed a coating of zinc conforming to ASTM A653 coating class G90 (both sides). Roof deck exposed to view, such as in the gymnasium, shall be cleaned and phosphatized prior to priming. Primer shall be applied in the shop and shall be structural steel primer or coil coating paint applied at a rate of 0.6 Mils DFT minimum). Salt spray resistance of paint shall be 100+ hours when tested in accordance with ASTM B117.

F. Metal Deck Accessories (cants, pour stops, closure pieces, etc.):

1. Shall conform to the requirements of ASTM A653, coating class G60. Unless a thicker gage is required by design considerations, such as at cantilever edge conditions, minimum thickness shall be same gage as metal deck. Accessories to receive sprayed fireproofing shall be free of lubricants and oils that would impair the adhesion of the fireproofing material.

G. Headed Stud Type Shear Connector:

1. Shall conform to the provisions of ASTM A108, meeting chemical requirements of ASTM A29, Grade 1010 through 1020, and Article 7.2.6 of AWS D1.1. Welded studs shown on the Drawing are the Basis of Design.

2. Mechanical Studs of equivalent strength to welded studs. Unless shown on the Contract Drawings, the size, number of and location on the beam shall be in accordance with the manufacturer's published data and supported by test data.

   a. Mechanical shear connectors shall be Hilti X-HVB Shear Connectors installed with Hilti X-ENP-21 HVB powder-actuated fasteners.

H. Welds and Fasteners:

1. Welds:

   a. Material: Welding electrodes shall conform to either E60XX or E70XX classification of AWS A5.1 as selected by the licensed welder depending on the gauge of steel deck and strength of steel member being welded to and is subject to approval by the Engineer of Record.

   b. Weld Washers: Use on steel roof deck thinner than 22 gauge

2. Mechanical Fasteners:

   a. Material: AISI 1070 modified
   b. Hardness: Minimum Rockwell Hardness C 54.5
   c. Design and Manufacture: Knurled shank with forged ballistic point. Manufacturing process shall ensure steel ductility and prevent development of hydrogen embrittlement.
   d. Washers:

1) For structural steel framing: Minimum 15 mm (0.591 in.) steel washers
2) For steel bar joist framing: Minimum 12 mm (0.472 in.) steel washers

e. Corrosion Resistance:

1) For steel roof decks with waterproofing membrane: 5 micron zinc electroplated in accordance with ASTM B 633 SC1 Type III
2) For exposed steel roof decks: Minimum AISI 304 stainless steel sealing caps with bonded neoprene washer shall be installed over each fastener

f. Design Requirements:

1) ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness
2) FM wind uplift resistance
3) UL fire classification

g. Approved Types

1) For use with structural steel framing supports with top flange thickness 1/4 in. or thicker:

a) Hilti X-ENP-19 L15 (1/4 in. or thicker)
b) ITW/Ramset SP

2) For use with steel bar joist supports with top chord or flange thickness 1/8 in. to 3/8 in.:

a) Hilti X-EDNK22 THQ12 (1/8 in. up to and including 1/4 in.)
b) Hilti X-EDN19 THQ12 (3/16 in. up to and including 3/8 in.)
c) ITW/Ramset 1500K and 1600WK

I. Sidelap Connectors:

1. Acceptable types of sidelap connectors:

a. Top or side seam welds

1) 1½" long fillet welds in accordance with AWS D1.3 procedures.

b. Mechanical sidelap connectors

1) Drive mechanical sidelap connectors completely through adjacent lapped roof deck sheets to achieve positive engagement of adjacent sheets with a minimum of three thread penetration.
2) Material: ASTM A510 Grade 1022
3) Hardness: Minimum Vickers Surface Hardness of 450 HV0.3
4) Design and Manufacture: Hex washer head undercut with reverse serrations; self-piercing or stitch point at center

5) Corrosion Resistance:

a) steel roof decks with waterproofing membrane: 5 micron zinc electroplated in accordance with ASTM B633 SC1 Type III.
b) For exposed steel roof decks: AISI 410 or 304 stainless steel with bonded neoprene washer.

6) Design Requirements:

a) ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness
b) FM wind uplift resistance

7) Approved Types:

a) Hilti S-SLC01 M HWH Sidelap Connector
b) Hilti S-SLC02 M HWH Sidelap Connector
c) Hilti S-MD 10-16x3/4 HWH #3 Stainless Steel Screw
d) Elco Textron
e) ITW Buildex Teks

c. Button punches

1) Standard or proprietary type button punches shall be deep and positively engage the male and female side edges of adjacent interlocking deck sheets in accordance with steel deck manufacturer recommendations

2) Approved Types

a) Wheeling Corrugating Gator Crimp
b) Verco Manufacturing Punchlok

J. Galvanizing Repair Paint

1. Shall conform to the requirements of ASTM A780 and comply with Military Specification MIL-P-21035.

K. Deck Fasteners (if used)

1. Deck fasteners of a type that will provide equal or greater uplift resistance than a 3/4" puddle weld.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin placement of metal deck until all surfaces and members are deemed acceptable to receive the deck. Do not proceed with Work until any unsatisfactory conditions have been corrected to the satisfaction of the deck installer.

3.02 ERECTION

A. General

1. Care should be taken to avoid overloading the supporting structural elements when placing bundles of metal deck or other construction loads on floors and roof.

2. Do not use floor deck units for storage or working platforms until they are permanently secured.

3. Employ a Licensed Professional Engineer or Land Surveyor to ensure accurate erection of the deck and end closures.

B. Metal Deck and Accessories Installation

1. Lay units in strict accordance with manufacturer's instructions and requirements and as shown on Drawings.

2. Adjust units in place before permanent fastening and accurately align end to end. Rectify inaccuracies in alignment and level of bearing before units are finally placed.

3. Provide proper bearing at all supports. Metal deck must be placed to bear fully on surface of beam flanges.

4. Provide angle and channel supports for metal deck at locations where deck cannot be properly seated due to obstructions by structural connections and as shown on Drawings. Coordinate with mechanical trades to adjust supports at columns if required to permit items to pass adjacent to column.

5. Anchor deck to steel member by welding directly through the bottom of the rib at all structural supports by welds not less than 3/4" in diameter or by using powder driven fasteners of equivalent strength, spaced not more than 12" across the width of the unit. All welds shall be of uniform size and appearance and free of pinholes, porosity, undercutting or other defects. Welds shall be free of sharp points or edges. Mechanical fasteners shall be fully engaged and washer snug and holding deck without damage. Where two units abut, each unit shall be so fastened to the steel framing. Add additional welds or fasteners where found defective.

6. Fasten side laps of adjacent units between supports by crimping or mechanically fastening with sheet metal screws of size and spacing required by manufacturer or as indicated on the Drawings to provide diaphragm strength required by seismic design. In no case shall fasteners exceed two feet. Fasteners for exposed to view roof deck shall be the minimum length possible to to ensure an aesthetic appearance.

7. Furnish, install, and weld in position all accessories, including pour stops, closures, cant strips, etc., where required.

    a. Furnish sheet metal pour stops and closures for open ends of all cell raceways at columns, walls, and openings shown on Drawings. Pour stop gage is to be selected by manufacturer based on overhang. Revise gage if survey shows overhang exceeds that designed. Provide additional supports to strengthen pour stop at wedge inserts if required.
    b. Provide sheet steel cover plate (or closure tape) as required to close panel end conditions where panels change direction or abut.
    c. Furnish material for column closures to close openings between panels and structural columns.
    d. Provide welding hole cover, with friction fastening, to close welding access holes when required.
    e. Provide smooth form wood edge at locations where edge of deck will be exposed to view, such as at stairwells.

C. Stud Shear Connector Welding:

1. Weld studs to steel beams through the steel deck with automatically-timed stud welding equipment.

2. Stud welding shall conform to the requirements of AWS D1.1 with respect to workmanship, quality control, and field inspection.

3. Manufacturer shall supply guidance and instruction in proper installation method

4. Additional requirements for stud welding with metal deck:

    a. Top flanges of beams must be free of paint, heavy rust, millscale, dirt, ice and water, and any other material that will interfere with the welding operation.
    b. Metal deck must be free of dirt, ice, water, and other foreign materials that will interfere with the welding operation.

D. Cutting, Drilling, and Reinforcing of Openings:

1. Where predetermined openings (such as stairs, elevators, etc.) are framed by structural steel beams on all sides (shown on the Drawings), the metal deck shall be engineered by the manufacturer to fit these conditions.

2. Any opening which is not framed by structural steel beams on all sides, and which is required in steel decking, shall be cut by the respective trades requiring it.

3. Reinforcing of Openings in Steel Deck

    a. Holes 6" or less in dimension need not be reinforced.
    b. Holes greater than 6" but less than 30" in any dimension shall be reinforced by the General Contractor as shown on the Structural Contract Drawings.

E. Field Touch Up

1. Clean scarred and rusted areas in galvanizing after deck installation is completed and paint welds and the scarred and rusted areas with the galvanizing repair paint. Apply in accordance with the manufacturer's instructions.

3.03 TOLERANCES

A. Edge of metal deck is to be within a tolerance of 1/4” of theoretical, set to a survey line, to ensure proper installation of masonry and installation of relieving angles. Where deck is found to be out of tolerance, make corrections and resurvey prior to placement of concrete.

3.04 FIELD QUALITY CONTROL

A. Welding/fastening of metal deck and shear studs is subject to Special Inspection and Testing and is included as part of the Quality Control Work of Section 051200 and includes but is not limited to.

1. Weld sizes and pattern.

2. Mechanical fastener placement location and washer condition.

3. Clamping of steel roof deck to supporting steel framing

B. The Contractor shall engage an engineer licensed in the state of New York to check tolerances and inspect the erection.

C. Contractors Surveys:

1. Provide survey of locations of edge of deck with respect to theoretical edge of deck and building survey line. Indicate discrepancies between actual installation and Contract Documents. Surveys are to be submitted in a timely manner such that corrections can be made prior to placement of concrete. Do not proceed with placing concrete until the pour stop locations are corrected.

3.05 CLEANING

A. Metal deck and accessories to receive sprayed fireproofing shall be clean of dust, grease, excessive oils, loose materials, and any other matter which would impair the adhesion of the fireproofing material to the deck and accessories.

END OF SECTION

LIST OF SUBMITTALS

SUBMITTAL	**DATE SUBMITTED**	**DATE APPROVED**
Product Data:	_____	_____
1. Stud shear connector 2. Deck fastener (if used) 3. Primer Paint		
Shop Drawings:	_____	_____
1. Metal deck drawings 2. Calculations		
Certificates:	_____	_____
1. Deck materials 2. Welders qualifications & license 3. UL for materials 4. Steel deck manufacturer is SDI member		
Manufacturer's Instructions:	_____	_____
1. Deck installation		
Qualifications	_____	_____
1. Manufacturer 2. Erector 3. Welder 4. Mechanical fastener technician		
Survey:	_____	_____
1. Deck edges		

* * *

DIVISION 05 – METALS

SECTION 054000 – COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.01 GENERAL

A. Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of cold formed framing as indicated on the drawings and specified herein. Shapes, sizes and accessories as specified and detailed shall establish the type of units and materials to be used to provide the functional and finished aesthetic requirements desired.

B. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 SUMMARY

A. Extent of cold-formed metal framing is shown on drawings.

B. Types of cold-formed metal framing units include the following:

1. Load-bearing and non-load bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Floor joist framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.

C. Related Sections include the following:

1. Section 033000 – Cast-in-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 051200 – Structural Steel Framing
4. Section 055000 – Metal Fabrications
5. Section 061000 – Rough Carpentry
6. Section 062000 – Finish Carpentry
7. Section 072100 – Building Insulation
8. Section 092900 – Gypsum Wallboard

1.03 REFERENCES

A. AISI – Specification for the design of cold-formed steel structural members, code of standard practice (COSP).
B. ASCE 7 – Minimum design loads for building or other structures.
C. ASTM A90 – Standard test method for weight (mass) of coating on iron and steel articles with zinc or zinc alloy coatings.
D. ASTM A370 – Standard test methods and definitions for mechanical testing of steel products.
E. ASTM A570 – Standard specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
F. ASTM A653 – Standard specification for steel sheet, zinc coated (galvanized) or zinc iron alloy coated (galvannealed) by the hot-dip process.
G. ASTM A780 – Standard practice for repair of damaged and uncoated areas of hot-dip galvanized coatings.
H. ASTM A924 – Standard specification for general requirements for steel sheet, metallic coated by

the hot-dip process.

I. ASTM A1003 – Standard specification for steel, sheet, cold rolled, carbon, structural, high strength low alloy and high strength low alloy with improved formability.
J. ASTM A1008 – Standard specification for steel, sheet and strip, hot rolled, carbon, structural, high strength low alloy and high strength low alloy with improved formability.
K. ASTM 1011 – Standard specification for steel, sheet and strip, hot rolled, carbon, structural, high strength low alloy and high strength low alloy with improved formability
L. ASTM B633 – Standard specification for elctrodeposited coatings of zinc and iron on steel.
M. ASTM C754 – Specification for installation of framing members to receive screw attached gypsum wallboard, backing board or water resistant backing board.
N. ASTM C840 – Standard specification for application and finishing of gypsum board.
O. ASTM C955 – Standard specification for load bearing (tranverse and axial) steel studs, runners (tracks), and bracing or bridging for screw application of gypsum panel products and metal plaster bases.
P. ASTM C1007 – Standard specification for installation of load bearing (transverse and axial) steel studs and related accessories.
Q. ASTM C1513 – Standard specification for steel taping screws for cold formed steel framing connections.
R. ASTM E84 – Standard test method for surface burning characteristics of building materials.
S. ASTM E90 – Method for laboratory measurement of airborne sound transmission loss of building partitions.

1.04 DESIGN REQUIREMENTS

A. Fire Resistive Rating: Where fire rated construction is indicated on drawings, provide materials and construction that are identical to those assemblies whose fire resistance rating has been determined per ASTM E119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

   1. Meet or exceed fire resistance requirements outlined under provisions of the GA-600 Fire Resistance Design Manual for wall and ceiling assemblies.

   2. Meet or exceed flame/fuel/smoke requirements of ASTM E84 surface burning characteristics for finish materials

B. Sound Transmission Characteristics: For specified wall assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.

C. AISI Specifications: Comply with AISI's current 'Specification for the Design of Cold-Formed Steel Structural Members' and the following for calculating structural characteristics of cold formed metal framing:

   1. CCFS Technical Bulletin: Current 'AISI Specification Provisions for Screw Connections'.

D. Fire Rated Assemblies: Where framing units are components of the assemblies indicated for a fire resistance rating, including those required for compliance with governing regulations, provide units which have been approved by governing authorities.

1.05 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. Product Data: For each type of cold-formed steel framing product and accessory, submit the following information:

1. Manufacturer's product data, including manufacturer's technical data sheet.
2. ICC-ES Reports.
3. Material Safety Data Sheets.
4. Preparation instructions and recommendations.
5. Storage and handling requirements and recommendations.
6. Installation methods.

C. Structural Calculations (For Structural Load Bearing or Supporting Assemblies):

1. Submit structural calculations prepared by manufacturer for approval. Submittal shall be sealed by a Professional Engineer registered in the state in which the project is located.
2. Description of design criteria.
3. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
4. Selection of framing components, accessories and welded connection requirements.
5. Verification of attachments to structure and adjacent framing components.
6. Engineer shall have a minimum of five (5) years experience with projects of similar scope.

D. Shop Drawings (For Structural Load Bearing or Supporting Assemblies):

1. Submit shop drawings prepared by the manufacturer showing plans, sections, elevations, layouts, profiles and product components locations, including anchorage, bracing, fasteners, accessories and finishes.
2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Show connection details with screw types and locations, weld lengths and locations and other fastener requirements.
4. Where prefabricated or prefinished panels are to be provided, provide drawings depicting panel configurations, dimensions and locations.

E. Welders Certificates: Submit manufacturers certificates, certifying welders employed on work, verifying AWS qualifications within the previous 12 months.

F. Mill Certificates: Signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Materials shall be provided by a firm that is experienced in manufacturing cold-formed metal framing similar to that indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for designing cold-formed metal framing and connections to comply with performance requirements. This responsibility includes preparation of Shop Drawings and design calculations by a qualified professional engineer.

B. Installer Qualifications: Work shall be installed by an experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Professional Engineer Qualifications: A professional engineer who is licensed to practice in the jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent. Engage a qualified Professional Engineer to prepare design calculations, shop drawings

and other structural data.

D. Mock-Up: When requested by the Architect or owner, contractor shall provide a 4'x4' mock-up for evaluation of workmanship for each type of cold formed metal framing specified/required by the project.

1. Construct areas designated by Architect.
2. Do not proceed with remaining work until material, details, and workmanship are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
4. Demolish mock-up at a time as a designated by the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturers unopened packaging until ready for installation.

B. Store materials protected from exposure to rain, snow or other harmful weather conditions, at temperature and humidity conditions per AISI COSP Section F3.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturers absolute limits.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Marino/WARE
2. ClarkDietrich Building Systems.
3. CEMCO; California Expanded Metal Products Co.

B. Source Limitations: Provide components and materials specified in this section form a single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified Professional Engineer registered in the state in which the project is located to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As noted on the Drawings.

2. Deflection Limits:

a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
c. Interior Non-Load Bearing Assemblies: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.

d. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
e. Floor Joist Framing: Vertical deflection of 1/360 for live loads and l/240 for total loads of the span.
f. Roof Rafter Framing: Vertical deflection of 1/120 of the horizontally projected span for live loads.
g. Ceiling Joist Framing: Vertical deflection of 1/120 of the span for live loads and 1/240 for total loads of the span.
h. Gypsum Board: 1/360 of span under total design loads.
i. Exterior Insulation Finish Systems: 1/360 of span under total design loads.
j. Plaster or Stucco: 1/360 of span under total design loads.
k. Brick Veneer: 1/600 of span under total design loads.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 1/2 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.03 COLD-FORMED STEEL FRAMING

A. System Components: With each type of metal framing required, provide manufacturer's standard U-shaped steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system as follows:

1. Load-Bearing Wall Framing:

a. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
b. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges.
c. Headers and Jambs - Heavy-Duty Stud: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with

stiffened flanges.

d. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges.
e. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated.

2. Interior Non-Load Bearing Wall Framing:

a. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
b. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.
c. Vertical Deflection Clips, Interior: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
d. Deflection Track and Firestop Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thicknesses not less than indicated for studs and in width to accommodate depth of studs.
e. Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure.
f. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure. Install a continuous row of bridging, composed of 1-1/2-inch cold-formed channel secured to each stud with clip angle, or bridging, or spacer bar, at upper-most knockout, not more than 12 inches from top of wall.
g. Firestop Track: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
h. Bridging and Spacer Bar as required.

3. Exterior Non-Load Bearing Wall Framing:

a. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
b. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.
c. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
d. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
e. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1) Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.
2) Inner Track: Of web depth indicated.

f. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud

from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

4. Floor Joist Framing:

    a. Steel Joists: Manufacturer's standard cold-formed steel joists, of web depths indicated, punched, with enlarged service holes, with stiffened flanges.
    b. Steel Joist Track: Manufacturer's standard cold-formed steel joist track, of web depths indicated, unpunched, with unstiffened flanges.

5. Roof Rafter Framing:

    a. Steel Rafters: Manufacturer's standard cold-formed steel joists used as rafters, of web depths indicated, punched with enlarged holes, with stiffened flanges.

6. Ceiling Joist Framing:

    a. Steel Ceiling Joists: Manufacturer's standard cold-formed steel joists, of web depths indicated, punched with enlarged service holes, with stiffened flanges.

7. Soffit Framing:

    a. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges.

B. Materials and Finishes:

1. For 16-gauge and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 50,000 psi; ASTM A 653, A 570, or A 611.

2. For 18-gauge and lighter units, which will only be attached mechanically, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 37,000 psi; ASTM A 653, A 570, or A 611.

C. Provide galvanized finish to metal framing components complying with ASTM A525 for minimum G90 coating.

1. Finish of installation accessories to match that of main framing components, unless otherwise indicated.

D. Hat Shaped Furring Channels: 22 gauge with minimum 1/2” wide flanges. Minimum depth 3/4” unless otherwise noted on drawings.

E. Framing Accessories:

1. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

2. Provide accessories of manufacturer’s standard thickness and configuration, unless otherwise indicated, as follows:

    a. Supplementary framing.
    b. Bracing, bridging and solid blocking.
    c. Web stiffeners.
    d. Utility angles.
    e. Rigid clips.

f. End clips.
g. Foundation clips.
h. Gusset plates.
i. Stud kickers and knee braces.
j. Joist hangers/Bridle hangers.
k. Hole reinforcing plates.
l. Backer plates.
m. U-Flex track.
n. Katz blocking.
o. BridgeRite clips.
p. Breakaway clips.

2.04 ANCHORS, CLIPS AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 and as indicated on drawings.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.05 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.06 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with

connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section

1. Fabricate framing assemblies in jig templates to hold members in proper alignment and position and to assure consistent component placement.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Framing components may be prefabricated into panels prior to erection. Perform lifting of prefabricated panels in a manner to prevent damage or distortion. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses.

C. Mechanical Fasteners: ASTM C1513, corrosion resistant coated, self- drilling, self-tapping steel drill screws. Minimum two (2) screws per connection.

D. Fabrication Tolerances: Fabricate assemblies level, plumb and true to line, to a maximum allowable tolerance variation of 1/8 inch in 10 feet, and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Pre-installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

1. Verify that concealed wood/sheet steel blocking has been installed the proper locations.

B. Examine substrates to which metal framed construction attaches or abuts. Verify pre-set hollow metal frames, cast in anchors, and structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of wall framing. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

A. Manufacturer's Instructions: Install metal framing systems in accordance with ASTM C 1007 and manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners. Provide fasteners at corners and ends of tracks.

1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
2. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
3. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim, and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

C. Installation of Wall Stud System: Secure studs to top and bottom runner tracks by screw fastening at both inside and outside flanges.

1. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.
2. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of the stud system. Independently frame both sides of joints.
3. Install horizontal stiffeners in the stud system, spaced (vertical distance) at not more than 4'-6" o.c. Mechanically fasten at each intersection.
4. Fasten hole reinforcing plates over web penetrations that exceed the size of the manufacturer’s standard punched openings.

D. Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true to line joints.

1. Step in face and jog in alignment between panels not to exceed 1/16".

E. Insulation: Install insulation in exterior framing members, headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

3.04 LOAD BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: To match stud spacing or as indicated on Shop Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated on drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-

framing system,

3.05 NON-LOAD BEARING WALL INSTALLATION

A. Install framing system components in accordance with spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16” o.c. unless otherwise indicated on the drawings.
2. Multilayer Application: 16” o.c. unless otherwise indicated on the drawings.
3. Tile Backing Panels: 16” o.c. unless otherwise indicated on the drawings

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 – Building Insulation, vertically and hold in place with Z-shaped furring members spaced 24” o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.06 EXTERIOR NON-LOAD BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as indicated on drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs or infill studs and anchor to building structure.
4. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

    a. Install solid blocking at centers indicated on Shop Drawings.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.07 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as indicated on the drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.08 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings and all welded areas on fabricated and installed cold-formed metal framing with galvanized repair paint, according to ASTM A 780 and manufacturer’s written instructions. Wire brush slag off of all welds.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

DIVISION 05 – METALS

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Provide all miscellaneous metal and metal fabrications, complete and installed, as shown on the Drawings, specified herein, or needed for a complete and proper installation of all building components, which may not be specifically called for under other sections of these Specifications.

B. Related Sections:

1. Section 042000 – Unit Masonry
2. Section 051200 – Structural Steel
3. Section 052100 – Steel Joists and Girders
4. Section 053000 – Metal Decking
5. Section 054000 – Cold-Formed Metal Framing
6. Section 055200 – Metal Railings
7. Section 055210 – Aluminum Railings
8. Section 057300 – Decorative Metal Railings

1.02 QUALITY ASSURANCE

A. Standards: Comply with standards specified herein and as listed in Section 014219 – Applicable Standards.

B. Qualifications of Personnel: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Welding: Perform all shop and field welding required in connection with the work of this Section, adhering strictly to the current pertinent recommendations of the American Welding Society.

1.03 SUBMISSIONS

A. Comply with provisions of Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Complete materials list of all items proposed to be furnished and installed under this Section.

2. Manufacturers' product data, specifications, and other data required to demonstrate compliance with specified requirements.

C. Shop Drawings: The Contractor shall prepare and submit shop drawings covering all items of work of this section. The drawings shall show all dimensions and details of construction, installation and relation to adjoining and related work where same requires cutting or close fitting, and shall show all reinforcement, gauges of metal, anchorage, reinforcing, and other work required for complete installation.

1. Provide templates for bolts and/or anchorage installation by other trades.

1.04 COORDINATION

A. All work under this section shall be properly coordinated with the work of other sections and contracts which affects or is affected by work of this section. To this end, close cooperation shall exist between trades and/or Contractors installing other work in any way affecting or affected by work under this section.

B. Shop drawings shall be exchanged between the trades and/or Contractors so affected to the end that all work shall properly receive or be received by work under other sections, and the entire operation shall be a harmonious whole.

1.05 WORKMANSHIP AND INSTALLATION

A. All work included under this section shall be installed by the contractor at the proper time, and as rapidly as progress of the adjacent and connecting work will permit. All work to be set by others shall be delivered when required by them. The Contractor shall consult with the various other contractors installing adjoining work regarding the methods to be employed in connecting the several materials. Holes and connections for the work of other trades shall be provided as necessary.

B. All work shall be erected and secured plumb and true to line, and finished smooth and clean from fine and noticeable irregularities or file marks. Ferrous metals entering or adjoining exterior masonry surfaces shall be insulated from it with lead shields and by an approved non-staining elastic cement of approved color.

1.06 VERIFYING CONDITIONS

A. Verify all measurements in the field, as required, for work fabricated to fit conditions at the building. Before starting work, examine all adjoining work on which the work of this section is in any way dependent for perfect workmanship and fit. Do such corrective work to adjoining work as may be necessary to make the work of this section perfect in all respects.

1.07 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All metals shall be free from defects impairing strength or durability, and of best commercial quality for purposes specified. Metals shall be made with structural properties to withstand safely the strains and stresses to which they will normally be subjected.

B. For fabrication of the work of this Section which will be exposed to view, use only those materials which are smooth and free from surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness.

C. Standards: All materials shall comply with the latest version of the standard documents indicated:

1. Steel plates, shapes, and bars: ASTM A36.

2. Steel plates to be bent or cold formed: ASTM A283, Grade C.

3. Steel tubing, hot-formed, welded, or seamless: ASTM A501.

4. Steel bars and bar-size shapes: ASTM A306 Grade 65, or ASTM A36.

5. Cold-finished steel bars: ASTM A108, grade as selected by the fabricator.

6. Cold-rolled carbon steel sheets: ASTM A336.

7. Galvanized carbon steel sheets: ASTM A526, with ASTM A525, G90, zinc coating.

8. Stainless steel sheets: Type 302/304 of American Iron and Steel Institute, 24 gauge, with No. 4 finish.

9. Gray iron castings: ASTM A48, Class 30.

10. Malleable iron castings: ASTM A47, grade as selected by the fabricator.

11. Steel pipe: ASTM A53, type as selected, Grade A, black finish unless galvanizing is required, standard weight (Schedule 40) unless otherwise indicated.

12. Concrete inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A47 or cast steel ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A153.

13. Non-shrink non-ferrous grout: CE CRD C588.

14. Aluminum extrusions shall be free of roll marks, scratches, rolled-in streaks and any other defect which may affect the uniform appearance of finished surfaces.

15. Aluminum extrusions must be at least 0.8" thick and sheet or plate, at least No. 16 gauge.

16. Aluminum pipe: 6063-T6 alloy.

17. Schedule of Aluminum Finishes:

    a. Exposed exterior extrusions (except saddles, louvers, railings, and windows): 215-R1.

    b. Exposed exterior sheet and plate: 215-R1.

    c. Exposed interior extrusions: 204-R1.

    d. Exposed interior sheet and plate: 204-R1.

    e. Extrusion, sheet plate not exposed: Mill.

    f. Casting: F.

2.02 WORKMANSHIP

A. General workmanship requirements:

1. Use materials of size and thickness shown, or if not shown, of required size and thickness to produce sufficient strength and durability in the finished product.

2. Work to dimensions shown or accepted on the Shop Drawings, using proven details of fabrication and support.

3. Use type of materials shown or specified for the various components of the work.

4. Form exposed work true to line and level, with accurate angles and surfaces and with straight, sharp edges.

5. Ease the exposed edges to a radius of approximately 0.8-mm (1/32") unless otherwise shown.

6. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

7. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush; match and blend with adjoining surfaces.

8. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, use Phillips flat-head (countersunk) screws or bolts.

9. Provide for anchorage of the type shown. Coordinate with supporting structure. Fabricate and space the anchoring devices to provide adequate support for intended use.

10. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

2.03 FABRICATIONS

A. Rough hardware:

1. Provide bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete and other structures.

2. Manufacture or fabricate items of sizes, shapes, and dimensions required.

3. Provide malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Loose bearing and leveling plates:

1. Provide loose bearing and leveling plates for steel items bearing on concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.

2. Drill plates for anchor bolts and for grouting as required.

3. Galvanize after fabrication.

C. Miscellaneous framing and supports:

1. Provide miscellaneous steel framing and supports which are not part of structural steel framework, as required to complete work.

2. Fabricate miscellaneous units to sizes, shapes, and profiles shown; or, if not shown, of required dimensions to receive adjacent other work to be retained by framing.

3. Fabricate the miscellaneous units from structural steel shapes, plates, and steel bars of welded construction with mitered joints for field connection, unless otherwise shown.

4. Cut, drill, and tap units to receive hardware.

5. Equip units with integrally welded anchors for casting into concrete or building into masonry, and furnish inserts if units must be installed after concrete is placed.

6. Except as otherwise shown on Construction Drawings, space anchors at 24" on centers, and provide minimum anchor units of 1-1/4" x 1/4" x 8" steel straps.

7. Galvanize miscellaneous frames and supports where indicated.

D. Loose Lintels:

1. Provide loose lintels for all trades, over all openings where lintels are not shown on structural drawings or where door bucks over 3'-0" wide are not reinforced. Provide loose lintels for all door bucks, greater than 5'-0" carrying masonry above. For each 4" thickness of masonry, provide one 3 1/2" x 3 1/2" x 5/16" angle at spans 3'-0" or less; 6" x 3 1/2" x 3/8" angle at spans 3'-0" to 6'-4". For 6" thick walls, provide WT 7 x 11 for spans 3'-0" to 6'-4". For spans 6'-4" to 8'-0" at 6" walls, provide WT 7 x 13. Provide lintels at heads of all aluminum bucks where not indicated on structural drawings.

2. All exterior lintels and miscellaneous framing to be galvanized.

E. Steel framed stairs:

1. General:

a. Use welding for joining pieces together, unless otherwise shown or specified. Fabricate units so that bolts and other fastenings do not appear on finish surfaces. Make joints true and tight, and make connections between parts lightproof tight. Provide continuous welds, ground smooth where exposed.

b. Construct stair units to conform to sizes and arrangements shown. Provide all components for the support of stairs and platforms.

2. Stair framing:

a. Fabricate stringers from structural steel channels, or plates, or a combination thereof as shown. Provide closures for ends of stringers.

b. Construct platforms of structural steel channel headers and miscellaneous framing members in the arrangement shown. Bolt or weld stringers to stringers.

3. Metal pan units: Form from structural steel sheet of the gauge shown on the drawings, and to the configuration shown on the drawings. Provide platforms of the same metal and gauge as indicated for pans, unless otherwise indicated.

F. Saddles:

1. Saddles shall be cast abrasive aluminum fitted to full width of frame opening.

2. Set level by shimming in full bed of mastic and fasten with FHCS screws.

2.04 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use and where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Standards: All fasteners shall comply with:

1. Bolts and nuts: Regular hexagon-head type, ASTM A307, Grade A.

2. Lag bolts: Square-head type, Fed. Spec. FF-B-561.

3. Machine screws: Cadmium plated steel, Fed. Spec. FF-S-92.

4. Wood screws: Flat-head carbon steel, Fed. Spec. FF-S-111.

5. Plain washers: Round, carbon steel, Fed. Spec. FF-W-92.

6. Masonry anchorage devices: Expansion shields, Fed. Spec. FF-S-325.

7. Toggle bolts: Tumble-wing type, Fed. Spec. FF-B-588, type, class, and style required.

8. Lock washers: Helical spring type carbon steel, Fed. Spec. FF-W-84.

2.05 PAINT/FINISHING

A. Shop priming:

1. Shop prime all ferrous miscellaneous metal work, except surfaces and edges to be field welded and galvanized surfaces, unless otherwise specified.

a. Remove oil, grease, and similar contaminants in accordance with SSPC-SP-1.

b. Clean off heavy rust and loose mill scale in accordance with SSPC-SP-2 or SSPC-SP-3.

c. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's recommendations, and at a rate to provide the recommended dry film thickness.

2. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

3. Primer for ferrous metals: 10-1009 Gray Metal Primer by Tnemec Co., Inc.

4. Primer for Loose and Hung Steel Lintels: 50-330 Poly-Ura-Prime by Tnemec Co., Inc.

a. Lintel angles for exterior veneer, either loose or hung, shall be hot dip galvanized. Final painting shall be after installation, but prior to installation of items such as windows or louvers that would conceal the lintel or portion thereof.

5. Non-visible ferrous metals, such as structural steel, bearing plates or anchorage, which will be exposed to building cavities or set below grade shall be painted with Benjamin more M47/M48 Coal Tar Epoxy.

6. All listed primers shall be compatible with finish coats of paint. Coordinate selection of metal primer with actual finish paint provided under Section 09900 of these Specifications.

2.06 GALVANIZING

A. Provide hot-dip zinc coating for those items shown or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing rolled, pressed, and forged steel shapes, plates, bar, and strip 3 mm (1/8") thick and heavier.

3. ASTM A386 for galvanizing assembled steel products.

B. Galvanizing repair paint: Use a high zinc dust content paint for regalvanizing welds in galvanized steel, or to repair damage incurred during handling and installation, complying with MIL SPEC MIL-P-21035.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which miscellaneous metal items are to be installed, and correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate delivery of such items to project site.

3.03 INSTALLATION

A. Setting loose plates:

1. Clean concrete bearing surfaces free from bond-reducing materials, and roughen to improve bond to surfaces. Clean the bottom surface of bearing plates.

2. Set loose leveling and bearing plates on wedges, or other adjustable devices.

3. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims; but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

4. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

B. Setting lintels:

1. Bear 8" minimum at each side of opening wherever possible. Furnish clip angles or other approved connection securely anchored to supporting construction and bolt to lintels wherever 8" bearing is not possible.

C. Installing stairs:

1. Install in accordance with approved shop drawings, providing all anchorage, welding, or bearing as specified on said shop drawings.

D. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

E. Cutting, fitting, and placement:

1. Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications.

2. Set work accurately in location, alignment, and elevation, and make plumb, level, true, and free from rack, measured from established lines and levels.

3. Provide temporary bracing or anchors in formwork for items which are to be built into concrete or similar construction.

4. Fit exposed connections accurately together to form tight hairline joints.

5. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.

6. Grind exposed joints smooth, and touch up shop paint coat. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

F. Field welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of weld made, and methods in correcting welding work.

G. Touch up painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

3.04 CLEANING, ACCEPTANCE, AND PROTECTION

A. All work shall be properly protected from defacement or damage. Defective work shall be satisfactorily repaired or removed and replaced at no additional cost to the Owner.

B. Upon completion, inspection, and approval by the Architect, the ornamental work of this section shall be cleaned with a mild soap and water or a petroleum distillate and all temporary protective coatings removed, except Methacrylate Lacquer.

C. All operative items shall be adjusted to work properly and the work left whole, clean, and in perfect condition.

END OF SECTION

DIVISION 05 – METALS

SECTION 055200 – METAL RAILINGS

PART 1 - GENERAL

1.01 RELATED WORK

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions of Division 01 Specification Sections, apply to work of this section.

1.02 WORK INCLUDED

A. Furnish and install all steel railing and related items indicated on the drawings and specified herein.

1.03 RELATED SECTIONS

A. Section 033000 – Cast-in-Place Concrete
B. Section 051200 – Structural Steel
C. Section 055000 – Miscellaneous Metal
D. Section 079200 – Joint Sealants
E. Section 099000 – Painting

1.04 SUBMITTALS

A. All submission shall be made in accordance with Section 013300 – Submissions and as may be modified below.

B. Shop Drawings:

1. Submit shop drawings of all items specified in accordance with the requirements of the General Provisions.

2. Shop drawings shall show welding, fabrication and installation of railings including all plans, typical elevations, details of components, and attachment to other units of work.

3. Where installed products are indicated to comply with certain design loading, include structural computations material properties and other information needed for structural analysis review by the Architect.

C. Samples:

1. Submit samples of items requested to illustrate fabrication, detail, and finish, as per the requirements of the General Provisions.

2. Identify all samples completely describing material, gauge, treatment, texture, finish, and color.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural performance of railing systems:

1. Engineer, fabricate and install railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for railings, anchors, and connections. Apply each load to product the maximum stress in each of the respective components comprising railing systems.

a. Top rail of guardrail systems: Capable of withstanding the following loads applied as indicated:

1) Concentrated load of 200lbs applied at any point and in any direction.
2) Uniform load of 50lb per linear foot applied horizontally and concurrently with uniform load of 100lb per linear foot applied vertically downward.
3) Concentrated load need not be assumed to act concurrently with uniform loads.

b. Handrails not serving as top rails: Capable of withstanding the following loads applied as indicated:

1) Concentrated load of 200lbs applied at any point and in any direction.
2) Uniform load of 50lb per linear foot applied in any direction.
3) Concentrated load need not be assumed to act concurrently with uniform load.

c. Infill area of guardrail systems: Capable of withstanding the following loads applied as indicated:

1) Horizontal concentrated load of 200lbs applied to one square foot at any point in the system.
2) This concentrated load need not be assumed to act concurrently with any other load.

2. Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.06 EXAMINATION AND COORDINATION

A. The Contractor's attention is directed to the other specification sections to ascertain the scope of reinforcing, supporting, and attachment steel work specified therein. Supplementary parts necessary to complete each item of miscellaneous metals, though such parts are not shown or specified, shall be included.

B. Examine all surfaces to which this work is to be attached. Notify the General Contractor if any conditions exist which are detrimental to the proper and timely installation of this work.

C. Cooperate in the coordination and scheduling of the work of this section with the work of other trades. Anchors, sleeves, framing, fastenings, and other miscellaneous items to be embedded in concrete or masonry, or required for securing metal work to other construction, shall be furnished as required so as not to delay the progress of the work.

D. Verify, by measurements at the job site, all dimensions affecting this work. Where railings are to fit to other construction, check actual dimension other construction before fabrication. Field dimensions which are at variance with those on the approved shop drawings shall be brought to the attention of the Architect. Where field measurements cannot be made without delaying the work, obtain guaranteed dimensions in writing and proceed without field measurements if specifically directed to do so. Starting of work will be construed as acceptance of surfaces.

E. Furnish all necessary templates and patterns required by other sections.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, receive, handle, and store all materials to prevent damage, deterioration, or delay. Remove defective materials from project site within 24 hours.

B. Store handrails and railing systems in clean, dry location away from uncured concrete and

masonry, protected against damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be new stock, free from defects impairing strength, durability or appearance and of best commercial quality for each intended purpose.

B. All steel posts, balusters, top and bottom rails shall be schedule 40 tubular or pipe carbon steel sections as indicated on the drawings, conforming to ASTM A53, Type S, Grade A.

1. In lieu of balusters, guardrail panels shall be provided as indicated and detailed on the drawings.

C. Handrails shall be steel, stainless steel, brass, or bronze as indicated on the drawings. If drawings do not indicate specific handrail material, then assume 1.5” dia. schedule 40 steel, painted.

D. Expansion shields, plugs, bolts, and other anchorage devices in masonry and concrete shall be of approved type. Ferrous types shall be galvanized. Fiber or wood plugs in masonry and concrete will not be accepted.

E. Galvanizing and Cadmium Plating:

1. Galvanizing of products after fabrication: ASTM A-123 and A-153.

2. Cadmium plating: ASTM A-165, Type TS.

2.02 MATERIAL STANDARDS

A. Steel Pipe - ASTM A-120.

B. Steel plates, shapes, and bars - ASTM A36.

C. Tubing - Hot-rolled, ASTD A501 or cold-rolled, ASTM A500.

D. Gray Iron Castings – ASTM A48, Class 30.

PART 3 - EXECUTION

3.01 FABRICATION AND ASSEMBLY

A. All work shall be fabricated in a first class manner by mechanics skilled in the trade, in accordance with basic details and information contained on the Construction Drawings.

B. All joints shall be as strong and rigid as adjoining sections. Welding shall be uniform and continuous along entire line of contact, except where spot welding is indicated or permitted.

C. Welding and bracing shall be of adequate strength and durability, with joining tight, flush, in plane, dressed, and smooth and clean.

D. Abutting bars shall pass through larger bars and be welded.

E. All welds shall be concealed where practical. Where exposed, welds shall be ground smooth.

F. Threaded connections shall be made up tight so that threads are entirely concealed. Removable members shall be carefully machined and fitted and secured by means of screws of bolts of proper size and approved spacing.

G. All fastening shall be concealed where practicable. Where exposed in finished surfaces, bolt and screw heads shall be flat and countersunk in exposed work and elsewhere as required unless otherwise shown or approved.

H. Long members shall be held together at end joints by concealed sleeves of similar shape, welded or braced in place, but designed to provide for expansion or contraction.

I. Fabrication, assembly, and fitting of the work shall be done in the shop, ready for installation at the site. Work which cannot be shop assembled shall be given a trial fit at the shop to insure proper field assembly.

3.02 GALVANIZING

A. If indicated on the Drawings, hot-dip galvanize assemblies and components in accordance with ASTM A-653 for G90 coating weight prior to painting.

3.03 PAINTING

A. Preparation:

1. All loose scale to be removed by blasting in accordance with SSPC-SP6. Blasting shall be done with an air compressor having a minimum capacity of 200 psi in an environmentally controlled environment with relative humidity not exceeding 80%. The blast media shall be cast steel grit; G25, G40, or G50 in accordance with SAE J1993.

2. The painting surface shall be clean and free of oil and dirt.

B. Painting:

1. The coating system shall be applied in a suitably designed paint spray booth capable of controlling environmental conditions. Paint shall not be applied when the air, steel, or paint materials are below 50˚ F or the humidity is above 80%.

a. Primer shall be a modified epoxy, high build, high solids primer.

b. The modified epoxy primer shall be applied to achieve a dry film thickness in the range of 4.0 to 6.0 mils.

c. Primer must be fully cured prior to the application of the finish coatings.

d. Any cracks and crevices at scrolls, circles or at sandwiched components, etc., to be filled using Tremco Dymonic polyurethane caulking after primer has cured.

e. Finish paint shall be International Interthane 990 low-VOC polyurethane paint.

f. Finish pant color shall be semi-gloss black, or other color as selected by the Architect.

g. The polyurethane finish paint shall be applied to achieve a dry film thickness to the range of 2.0 to 3.0 mils.

h. The paint shall be fully cured prior to installation.

C. The finished product shall be free of runs, sags, pinholes and holidays.

3.04 POWDER COATING (if identified in lieu of painting)

A. When noted on the Drawings, provide a two-coat powder coating system applied as per manufacturers specifications.

1. Clean all surfaces of oily or greasy residues, dirt, mill scale, oxidation, etc.

2. Mechanical pretreatment by abrasive blasting or liquid chemical pretreatment by zinc phosphate immersion.

3. Powder primer coat, Tiger Dryprotector 69/70111 or equivalent.

4. Powder finish coat, Tiger Drylac Series 75, semi-gloss, or equivalent.

B. Colors shall be as selected by Architect.

3.05 INSTALLATION

A. Perform cutting, drilling and fitting required for installation. Set products accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels.

B. Allow for thermal movement resulting from maximum change in ambient temperature, in the design, fabrication and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners.

C. Provide necessary lugs and brackets for assembly of units. Use concealed fasteners wherever possible.

D. Posts shall be set in concrete in accordance with any of the following methods:

1. Set in position during concrete pouring. Provide temporary bracing as required for setting of items until adequate cure time is achieved.

2. Core-drilling existing or new concrete, embedding posts a min. of 8” deep, and filling with setting cement. Top of setting cement must be slightly higher than surrounding concrete and sloped for drainage.

3. Setting sleeves in new concrete during pouring to accommodate posts in lieu of core-drilling. Follow setting instructions above.

4. In instances where railings are not associated with stairs, walls, or slabs, provide concrete footings, sizes as appropriate to the steel member being embedded, and submitted to and approved by the Architect. Footings shall be set 1” above finished grade and tops shall be sloped outwards for drainage.

E. Provide anchoring devices and fasteners where necessary for securing metalwork to existing construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, etc. Such accessories shall be furnished in ample time for setting and securing in place.

F. Field Welding: Comply with applicable AWS specifications for procedures, for appearance and quality of welds made, and for methods used in correcting welding work. Field-welded connections, which are not to be left as exposed joints, are only permissible where items cannot be shop welded,

because of shipping size or other physical limitations. Grind exposed welded joints smooth and restore to match finish of adjacent surfaces.

G. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material.

H. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required, all at the discretion of the Architect.

3.06 CLEANING, ACCEPTANCE, AND PROTECTION

A. All work shall be properly protected from defacement or damage. Defective work shall be satisfactorily repaired or removed and replaced at no additional cost to the Owner.

END OF SECTION

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this Section.

1.02 SUMMARY

A. Types of work in this section include rough carpentry for:

1. Framing with dimensional lumber as shown on the drawings and as specified herein.

2. Plywood, OSB, particleboard panels and/or other sheathing as shown on the drawings and as specified herein.

3. Wood blocking, nailers and/or sleepers.

1.03 RELATED SECTIONS

A. Section 061643 – Exterior Gypsum Sheathing
B. Section 061713 – Laminated Veneer Lumber
C. Section 062000 – Finish Carpentry
D. Section 072100 – Building Insulation
E. Section 072113 – Ultra Wall Insulation and Air Barrier System
F. Section 072423 – Direct Applied Exterior Finish Systems
G. Various Division 07 Roofing Specifications
H. Various Division 09 Finishes Specifications
I. If designated as a LEED project, then also:
   1. Section 013563 – LEED Requirements
   2. Section 017419 – Construction Waste Management

1.04 REFERENCES

A. AWPA – (American Wood Preservers Association) – All Timber Products Preservative Treatment by Pressure Process.

B. APA – American Plywood Association.

C. AITC – American Institute of Timber Construction.

D. US Department of Commerce (DOC):

1. DOC PS 1 – Performance Standard for Structural Plywood.
2. DOC PS 2 – Performance Standard for Wood-Based Structural Panels.

1.05 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

B. Exposed Framing: Framing not concealed by other construction.

C. Dimensional Lumber: Lumber of 2 inches nominal or greater, but less than 5 inches nominal in least dimension.

D. Timber: Lumber of 5 inches nominal or greater in least dimension.

1.06 QUALITY ASSURANCE

A. All materials shall be provided and all work shall be performed in accordance with the NYS Building Code requirements (current version).

B. Lumber shall be certified by the following authorities/grading agencies:

1. NELMA: Northeastern Lumber Manufacturers' Association.

2. NLGA: National Lumber Grades Authority.

3. RIS: Redwood Inspection Service.

4. SPIB: The Southern Pine Inspection Bureau.

5. WCLIB: West Coast Lumber Inspection Bureau.

6. WWPA: Western Wood Products Association.

7. FSC: Forest Stewardship Council.

1.07 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Material Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit a listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in forms of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.

C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Plywood.
4. Engineered wood products.
5. Shear panels.
6. Power-driven fasteners.
7. Powder-actuated fasteners.
8. Expansion anchors.
9. Metal framing anchors.

D. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.

1. Preservative Treatment: For each type specified, include certification by treating plant stating

type of preservative solution and pressure process used, note amount of preservative retained, and conformance with applicable standards.

a. For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

b. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

E. LEED Submittals; for projects requiring LEED certification, submit the following additional information:

1. Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 – LEED Requirements.

2. Credit EQ 4.1: Manufacturers' product data for interior field-applied construction adhesive, including printed statement of VOC content in accordance with Section 013563 – LEED Requirements.

3. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that product's bonding agent contains no urea formaldehyde in accordance with Section 013563 – LEED Requirements.

4. Forest Certification for the following wood products; materials produced from wood obtained from forests certified by a Forest Stewardship Council (FSC)-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

a. Dimensional lumber framing.

b. Plywood.

1.08 DELIVERY, STORAGE AND PRODUCT HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels flat with spacers between each bundle to provide for air circulation around stacks and under coverings.

PART 2 - MATERIALS

2.01 LUMBER, GENERAL

A. Lumber Standards: Manufacture lumber to comply with *"Voluntary Lumber Standard"* DOC PS20-10, or most current edition, and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

1. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill..

2. Where nominal sizes are indicated, provide actual sizes required by DOC PS20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

3. Provide dressed lumber, S4S, unless otherwise indicated.

4. Plywood Standards: Comply with the latest edition of U.S. Product Standard PSI and APA performance standards.

5. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:

1. SPIB: Southern Pine Inspection Bureau.
2. WWPA: Western Wood Products Association.

C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing and mill.

2.02 FRAMING LUMBER

A. For items of dimensional lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content of any species, unless otherwise noted on the Construction Drawings.

1. Hem-fir (north); NLGA.

2. Mixed southern pine; SPIB.

3. Spruce-pine-fir; NLGA.

4. Hem-fir; WCLIB, or WWPA.

5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

6. Species group below includes hem-fir and spruce-pine-fir (south).

7. Western woods; WCLIB or WWPA.

8. Northern species; NLGA.

2.03 MISCELLANEOUS LUMBER

A. Provide wood for support or attachment of other work including cant strips, nailers, blocking, furring, grounds, stripping, rooftop equipment bases and support curbs, and similar members. Provide lumber sizes indicated, worked into shapes shown.

B. Grade: Standard grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.

2.04 PLYWOOD PANELS AND ROOF SHEATHING

A. Plywood must contain no urea-formaldehyde resins.

B. Telephone and Electrical Equipment Backing Panels: DOC PS1, Exposure 1, C-D Plugged, in thicknesses as indicated, not less than ½ inch nominal thickness.

C. Plywood Roof Sheathing: Exposure 1, Structural 1 sheathing.

1. Span Rating: Not less than 48/24.

2. Nominal Thickness: Not less than 23/32 inch.

2.05 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, material, and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers, and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

1. Where rough carpentry work is exposed to weather, in ground contact, pressure-preservative treated, or in areas of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating, complying with ASTM A153.

2. Nails, brads and staples shall comply with ASTM F 1667.

3. Power-Driven fasteners shall comply with NES NER-272.

4. Wood Screws shall comply with ASME B18.6.1.

5. Lag Bolts shall comply with ASME B18.2.1.

6. Bolts: Steel bolts shall comply with ASTM A307, Grade A; with ASTM A563 hex nuts and, where so indicated, flat washers.

7. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

a. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

b. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

B. Building Paper: Asphalt saturated felt, non-perforated conforming to ASTM D226.

C. In the absence of requirements of section 07231, provide a self-adhering vapor-permeable air barrier membrane; Blueskin Breather manufactured by Henry; a self-adhering membrane consisting of a microporous film laminate, backed with a specially applied adhesive, which allows water vapor to permeate through while acting as a barrier to air and rain water. Membrane shall have the following physical properties:

1. Air leakage: <0.002 CFM/ft2 @ 1.6 lbs/ft2 to ASTM E283-91.

2. Water vapor permeance: 37 perms to ASTM E 96.

3. Membrane Thickness: 17 mils.

4. Low temperature flexibility -40 degrees F: Pass to ASTM D3111.

5. Hydrostatic Water Resistance: 18 psi ASTM D751 Procedure

D. Sill Sealer Gaskets: Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1" nominal thickness compressible to 1/32"; selected from manufacturer's standard widths to suit width of sill members indicated; in rolls of 50' or 100' in length.

E. Water-Repellent Preservative: (for exposed ends of posts and beams, not for treating cuts in preservative-treated lumber): NWWDA-tested and accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

F. Construction Adhesive: Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.06 METAL FRAMING ANCHORS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or engineered-approved equals by one of the following:

1. Simpson Strong-Tie Co., Inc.
2. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet, complying with ASTM A 653, G60 (Z180) coating designation.

D. Joist Hangers: U-shaped joist hangers with 2-inch long seat and 1-1/4-inch wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.062 inch.

E. I-Joist Hangers: U-shaped joist hangers with 2-inch long seat and 1-1/4-inch wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

1. Thickness: 0.062 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 1-1/2 inches.
2. Thickness: 0.062 inch.

G. Bridging: Rigid, V-section, nail-less type, 0.050 inch thick, length to suit joist size and spacing.

H. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 1-1/4 inches.
2. Thickness: 0.062 inch.
3. Length: As indicated.

I. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fasteners to side of rafter or truss, face of top plates, and side of stud below.

J. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

K. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

L. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: 3/4 inch.
2. Width: 3-3/16 inches.
3. Body Thickness: 0.138 inch.
4. Base Reinforcement Thickness: 0.108 inch.

M. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches (29 mm) wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.

N. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.07 FIRE RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:

1. Flame-spread index of not greater than 25 when tested according to ASTM E 84.

B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

C. Exterior-Type Fire-Retardant Treatment: Organic-resin-based formulation that shows no increase in flame spread of treated material after being weathered according to ASTM D 2898, Method A.

D. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Acceptable pressure-impregnated products include Hoover’s Pyro-Guard for interior applications and Exterior Fire-X for exterior applications.

2.08 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: Where lumber or plywood is indicated as "Trt-Wd" or "Treated," or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX). Mark each treated item with the AWPB Quality Mark Requirements, and with the quality mark of an inspection agency approved by the ALSC Board of Review.

1. Pressure-treat above-ground items with water-borne preservatives to comply with AWPB LP-2, acceptable to authorities having jurisdiction and containing no arsenic or chromium. After

treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Do not use material that is warped or does not comply with requirements for untreated material. Treat indicated items and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
d. Wood framing members less than 18" above grade, in crawl spaces or unexcavated areas.
e. Wood floor plates that are installed over concrete slabs-on-grade.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units with material defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other work.

D. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

1. Unless otherwise indicated on the Construction Drawings, framing shall be at 16” centers.

E. Metal Anchors for Engineered Wood Products (where applicable): Install metal anchors to comply with manufacturer's written instructions.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Comply with Table 2304.10.1 – “Fastening Schedule” in ICC’s International Building Code. Provide all blocking and framing as indicated and as required in order to support facing materials, fixtures, specialty items, and trim.

I. Use common wire nails, except as otherwise indicated; use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

J. Do not splice structural members between supports.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Provide wherever shown and where required for attachment to other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrate as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.03 WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness, whose widths equal that of studs. Fasten plates to supporting construction.

1. Space wood studs at 16 inches o.c., unless otherwise indicated.

2. Provide continuous horizontal blocking at mid-height of partitions more than 96 inches high, using members of 2-inch nominal thickness, and of same width as wall or partitions.

B. Construct corners and intersections with three (3) or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb (jack) studs.

1. For load-bearing walls, provide double-jamb (jack) studs for openings 60 inches and less in width, and triple-jamb (jack) studs for wider openings. Provide headers of depth indicated on the drawings.

D. Provide diagonal bracing in walls, at locations indicated, full-story height, unless otherwise indicated.

3.04 FLOOR JOIST FRAMING

A. Space joists at 16 inches o.c., unless otherwise indicated.

1. Set each joist with crown up.

2. Provide continuous horizontal blocking at mid-span of joists, using members of same nominal size of joists.

B. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of joists.

1. Provide double-joists, nailed together, directly beneath non-bearing partition walls when joist run parallel to said walls.

3.05 RAFTER FRAMING

A. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut ridge, place directly opposite each other and nail to ridge member, or use metal ridge

hangers.

1. Space wood rafters at 16 inches o.c., unless otherwise indicated.

2. Set each rafter with crown up.

B. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.06 PLYWOOD SHEATHING

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Install with the long dimension of the panel across supports, except where noted, and with panel continuous over two or more spans. Suitable edge support shall be provided where indicated on drawings (or in recommendations of the American Plywood Association) by use of panel clips, tongue-and-groove panels, or lumber blocking between joists. Panel end joints shall occur over framing. Allow 1/8-inch spacing at panel ends and 1/4-inch at panel edges, unless otherwise recommended by the panel manufacturer.

C. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.

D. Nail 6 inches o.c. along panel edges and 12 inches o.c. at intermediate supports, except that when supports are spaced 48 inches o.c. or more, space nails 6 inches o.c. at all supports. Use 6d common nails for panels 1/2-inch and less and 8d for greater thicknesses, except that when panels are 1-1/8 inch, use 8d ringshank or 10d common.

3.07 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

SECTION 061643 – EXTERIOR GYPSUM SHEATHING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this Section.

1.02 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture-resistant gypsum sheathing.

1.03 RELATED SECTIONS

A. Section 054000 – Cold Formed Metal Framing
B. Section 061000 – Rough Carpentry
C. Section 072100 – Building Insulation
D. Section 072113 – Ultra Wall Insulation and Air Barrier System
E. Section 072423 – Direct Applied Exterior Finish Systems
F. Various Division 07 Roofing Specifications
G. Various Division 09 Finishes Specifications
H. If designated as a LEED project, then also:
   1. Section 013563 – LEED Requirements
   2. Section 017419 – Construction Waste Management

1.04 REFERENCES

A. ASTM International (ASTM):

   1. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products.
   2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   3. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   4. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   5. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
   6. ASTM C1396 - Standard Specification for Gypsum Board.
   7. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   8. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
   9. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
   10. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   12. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.05 SUBMITTALS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Submit manufacturer's specifications, product data and installation instructions for each product specified.

C. LEED Submittals; for projects requiring LEED certification, submit the following additional information:

1. Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 – LEED Requirements.

1.06 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.

B. Manufacturer's Warranty:

1. Five years against manufacturing defects.

2. Twelve years against manufacturing defects when used as a substrate in architecturally specified EIFS.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. To establish a level of quality and standard of performance, this section is based on the following products and manufactured by Georgia-Pacific Gypsum LLC:

1. Fiberglass-Mat Faced Gypsum Sheathing: DensGlass Sheathing, or architect approved equal.
2. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.

2.02 MATERIALS

A. Fiberglass-Mat Faced Gypsum Sheathing, ASTM C1177: DensGlass Exterior Sheathing, Georgia-Pacific Gypsum.

1. Thickness: 1/2" or 5/8" as indicated on drawings.

2. Width: 4 feet.

3. Length: 8 feet, 9 feet or 10 feet.

4. Weight: 1.9 lbs/sq.ft.

5. Edges: Square.

6. Surfacing: Fiberglass mat on face, back, and long edges.

7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.

8. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.

9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.

10. Permeance (ASTM E96): Not less than 23 perms.

11. R-Value (ASTM C518): 0.56 (1/2”); 0.67 (5/8”).

12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.

13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

B. Fire-Rated (Type X) Fiberglass-Mat Faced Gypsum Sheathing, ASTM C1177: 1/2 inch and 5/8 inch DensGlass Fireguard Type X Exterior Sheathing, Georgia-Pacific Gypsum.

1. Thickness: 5/8”

2. Width: 4 feet.

3. Length: 8 feet, 9 feet or 10 feet.

4. Weight: 2.5 lb/sq. ft.

5. Edges: Square.

6. Surfacing: Fiberglass mat on face, back, and long edges.

7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.

8. Flexural Strength, Parallel (ASTM C1177): 100 lbf, parallel.

9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.

10. Permeance (ASTM E96): Not less than 17 perms.

11. R-Value (ASTM C518): 0.67 (5/8”).

12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.

13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

2.03 ACCESSORIES

A. Screws: ASTM C1002, corrosion-resistant treated.

B. In the absence of requirements of section 072113, provide a self-adhering vapor-permeable air barrier membrane; Blueskin Breather manufactured by Henry; a self-adhering membrane consisting of a microporous film laminate, backed with a specially applied adhesive, which allows water vapor to permeate through while acting as a barrier to air and rain water. Membrane shall have the following physical properties:

1. Air leakage: <0.002 CFM/ft2 @ 1.6 lbs/ft2 to ASTM E283-91.

2. Water vapor permeance: 37 perms to ASTM E 96.

3. Membrane Thickness: 17 mils.

4. Low temperature flexibility -40 degrees F: Pass to ASTM D3111

5. Hydrostatic Water Resistance: 18 psi ASTM D751 Procedure

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Inspection: Verify that project conditions and substrates are acceptable to the installer, to begin installation of work of this section.

2. Commencement of the work represents acceptance of the substrate conditions.

3.02 INSTALLATION

A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.

1. Manufacturer's Recommendations:

a. Current "Product Catalog", Georgia-Pacific Gypsum.

2. Fastening:

a. Provide fastening materials and methods as recommended by the manufacturer for the particular substrate construction.
b. Fastening shall be in accordance with governing codes.
c. Fastening shall be in accordance with any governing FM requirements.

3. Air barrier:

a. Install self-adhering permeable air barrier transition membrane unless other air barrier systems are specified.

3.03 PROTECTION

A. Protect gypsum board installations from damage and deterioration until finished exterior materials are applied.

END OF SECTION

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

SECTION 062000 – FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions, Division 01 Specification sections, apply to work of this section.

1.02 SUMMARY

A. Types of work in this section include finish carpentry for:

1. Exterior standing and running trim.
2. Interior standing and running trim.
3. Interior plywood.
4. Window stools & aprons.
5. Closet shelving.

B. Casework, cabinetry, countertops, and wainscot paneling systems are specified in other Division 06, Division 11, and Division 12 sections.

1.03 RELATED SECTIONS

A. Section 061000 – Rough Carpentry
B. Various Division 09 Finishes Specifications
C. If designated as a LEED project, then also:
   1. Section 013563 – LEED Requirements
   2. Section 017419 – Construction Waste Management

1.04 QUALITY ASSURANCE

A. Lumber: Comply with Voluntary Product Standard PS-20. Lumber shall bear grade and trademark of the association under whose rule it is produced.

1. Southern Forest Products Association (SFPA).

2. West Coast Lumber Inspection Bureau (WCLIB).

3. American Plywood Association (APA).

4. Western Wood Products Association (WWPA).

5. American Wood Preservers Bureau (AWPB).

6. National Woodwork Manufacturer's Association (NWMA).

7. National Hardwood Lumber Association (NHLA).

8. Architectural Woodwork Institute (AWI).

9. Wood Moulding and Millwork Producers (WM).

10. Forest Stewardship Council (FSC).

B. Plywood Grading Rules:

1. U.S. Product Standard PS 1-83 for Construction and Industrial Plywood.

2. American Plywood Association (A.P.A.).

C. Perform finish carpentry in accordance with AWI Quality Standards, "Custom" grade, unless otherwise noted.

1.05 SUBMISSIONS

A. All submissions shall be made in accordance with Section 01300 – Submittal Procedures and as modified below.

B. Submit shop drawings and product data for architectural woodwork. Indicate materials, component profiles, jointing details, finishes, and accessories.

1. If requested, provide 6” long samples of trim pieces.

C. LEED Submittals; for projects requiring LEED certification submit the following:

1. Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 “LEED Requirements”.

2. Credit EQ 4.1: Manufacturers' product data for interior field-applied construction adhesive, including printed statement of VOC content in accordance with Section 013563 “LEED Requirements”.

3. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that product’s bonding agent contains no urea formaldehyde in accordance with Section 013563 “LEED Requirements”.

4. Forest Certification for the following wood products; materials produced from wood obtained from forests certified by a Forest Stewardship Council (FSC)-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

a. Finish lumber and moldings.

b. Finish plywood, veneers.

1.06 DELIVERY, STORAGE AND PRODUCT HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

B. Do not deliver finish carpentry materials, until painting, wet work, grinding, and similar operations which could damage, soil, or deteriorate woodwork have been completed in installation areas.

C. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - MATERIALS

2.01 SEASONING

A. Moisture Content: Except grades and species having a definite moisture content limitation under established grading rules, lumber shall be kiln-dried to a maximum moisture content of twelve percent (12%).

2.02 EXTERIOR STANDING AND RUNNING TRIM

A. Trim shall be of sizes, configurations, and profiles as indicated on the drawings for the following applications.

1. Finished lumber.

2. Door and window casings.

3. Fascia, rake, and associated trim.

4. Other applications as may be detailed on the drawings.

B. Exterior applications shall be clear all-heart redwood, clear heart western red cedar, southern yellow pine, or black locust, unless otherwise noted on the drawings as a different species or resin-based, hardboard, or composite material.

1. Provide WM grade P for opaque/painted finish.

2. Provide WM grade N for natural/stained finish.

2.03 INTERIOR STANDING AND RUNNING TRIM

A. Trim shall be of sizes, configurations, and profiles as indicated on the drawings for the following applications.

1. Finished lumber.

2. Door and window casings.

3. Wall base molding.

4. Chair rails.

5. Crown moldings.

6. Picture moldings.

7. Other applications as may be detailed on the drawings.

B. Interior softwood applications shall be select eastern white pine or sapwood birch; hardwood applications shall be white oak, red oak, or hard maple, unless otherwise noted on the drawings as a different species or resin-based, hardboard, or composite material.

1. Provide WM grade P for opaque/painted finish.

2. Provide WM grade N for natural/stained finish.

2.04 INTERIOR PLYWOOD

A. Exposed finished plywood applications shall utilize furniture-grade plywood of a face species coordinating with specified trim or as indicated on the drawings.

1. Provide Type II interior sound grade for opaque/painted finish.

2. Provide Type II interior grade A for natural/stained finish.

B. Thicknesses shall be as indicated on the drawings.

1. Shelving plywood shall be nominal 3/4” minimum.

C. Comply with PS 1-83. Interior plywood in proximity to water (toilet rooms, sinks, etc.): manufactured with exterior glue.

1. Plywood must contain no urea-formaldehyde resins.

2.05 WINDOW STOOLS & APRONS

A. Window stools shall be constructed of hardwood lumber species as indicated on the drawings. If no species is indicated, bids shall be based upon red oak.

1. Utilize nominal 1” board stock for widths of 7-1/4” or less. For wider applications, utilize nominal 5/4” board stock.

2. Exposed edges shall be bullnosed.

B. Aprons shall be of similar species as window stools and shall be wide enough to cover rough wood blocking or GWB edge transition beneath.

2.06 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide nails, screws, and other anchoring devices of the proper types, size, material, and finish for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications and reference AWI standard.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition materials to average prevailing humidity conditions in installation areas prior to installing.

B. See Section 061000 – Rough Carpentry for installation of recessed wood blocking.

C. Prime and backprime lumber for painted finish exposed on the exterior. Comply with requirements for surface preparation and application in Section 099000 – Painting & Staining.

3.02 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes, or patterns.

B. Product joints which are true, tight, and well nailed with all members assembled in accordance with the Drawings. Field sand all finish trim material smooth, except Cedar, to remove saw marks, raised grain, etc. Cut all corners square and ease slightly.

C. Jointing: Make joints to conceal shrinkage; miter exterior joints; cope interior joints; miter or scarf end-to-end joints. Install trim in pieces as long as possible, jointing only where solid support is obtained.

1. Door and window casings shall be single lengths without splicing.

D. Fastening:

1. Install items straight, true, level, plumb, and firmly anchored in place.

2. Where blocking or backing is required, coordinate as necessary with other trades to ensure placement of required backing and blocking in a timely manner.

3. Nail trim with finish nails of proper dimension to hold the member firmly in place without splitting the wood.

4. Nail exterior trim with galvanized nails, making joints to exclude water.

5. On exposed work, set nails for putty.

E. Prime paint surfaces in contact with cementitious materials or separate with felt.

3.03 INSTALLATION OF OTHER ITEMS

A. Set items at locations shown, in perfect alignment and elevation, plumb, level, straight, true and free from rack, scribed to adjoining work.

B. Appearance: finished surface shall be free of tool marks.

3.04 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION

A. Keep premises in a neat, safe, and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends, and debris.

B. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

C. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.

D. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintain condition necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

SECTION 068400 – ARCHITECTURAL COMPOSITE COLUMNS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the contract, including General and Supplementary Conditions and Division 01 – Specification Sections, apply to work of this contract.

1.02 WORK INCLUDED

A. Furnish all labor, material, tools, and equipment necessary or required to perform and complete the installation of the following as indicated on the drawings and as specified herein:

1. Columns: HB&G PermaCast Load-bearing columns; fiber-reinforced polymer composite; weatherproof, insect-proof, and highly durable.

2. Columns: HB&G PermaWrap Cellular Polyvinyl Chloride (PVC) columns; decorative, weatherproof, insect-proof, and highly durable.

3. Decorative Capitals and Bases: To fit over shaft through center of capital and base without affecting height of the column, except for "ornate" styles of capitals for round columns.

4. Materials for column installation.

B. Coordinate all work with the installation of all roof, soffit and fascia carpentry.

1.03 RELATED SECTIONS

A. Section 061000 – Rough Carpentry
B. Section 076000 – Flashing and Sheet Metal
C. Section 079200 – Joint Sealants
D. Various Division 07 Thermal and Moisture Protection sections.
E. Section 099000 – Painting

1.04 SUBMITTALS

A. Prior to the start of installation, the installing contractor shall furnish manufacturer’s product data, specification, and layouts, standard detail drawings, and installation instruction indicating products to be used to conform to these specifications.

B. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

C. Product Data:

1. Submit manufacturer’s product data, specifications, and installation instructions. Include test data substantiating that columns and all associated components comply with specified requirements.

D. Shop Drawings: For custom products, show dimensions, configuration, and anchorages.

E. Selection Samples: Two complete sets of color photographs representing manufacturer's full range

of available materials and styles.

1.05 QUALITY ASSURANCE

A. Installing contractor shall be responsible for installing columns in accordance with manufacturers printed instructions.

B. Installer shall be experienced in the installation of specified columns for not less than five (5) years.

C. Fiber – Reinforced polymer columns shall have a “Lifetime Warranty” for defects in material and workmanship.

1.06 DESIGN REQUIREMENTS

A. Column type shall be round or square; straight or tapered; smooth, fluted, or paneled; as indicated on the drawings.

1. If no type is indicated on the drawings, assume round, tapered, smooth for bidding purposes.

B. Column length shall be as indicated on the drawings from a minimum of 5’-0” to a maximum of 24’-0”.

C. Column diameter shall be as indicated on the drawings.

D. Column base shall be round or square and of coordinating diameter.

1. Base style shall be as indicated on the drawings: Attic, Tuscan, Doric, or Colonial style.

2. If no base style is indicated on the drawings, assume Tuscan base for bidding purposes.

E. Capital shall be round or square and of coordinating diameter.

1. Capital style shall be as indicated on the drawings: Tuscan, Doric, Colonial, Crown, Ionic, Corinthian, or Scamozzi style.

2. If no capital style is indicated on the drawings, assume Tuscan capital for bidding purposes.

F. Structural load capability of 8,000 lbs. for 6” diameter column to 20,000 lbs. for 24” diameter column.

1. Although columns are capable of structural loading, they are intended to be decorative only unless otherwise noted and detailed on the drawings with appropriate structural anchors and connections.

2. Provide split columns for structural column encasement, corner, or embedded conditions.

a. Joining of split columns for structural column encasement shall be performed and finished in accordance with manufacturer’s requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. All products delivered shall be stored in a clean, dry location prior to installation.

B. Inspect material upon delivery and order replacements for any missing or defective items.

C. Products furnished with strippable protective plastic film should have film removed prior to installation. Such film-coated products shall not be exposed to sunlight for more than 30 minutes

without removing film.

D. Workmen shall use diligent care to avoid damage, scars, and abrasions to product when handling.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 WARRANTY

A. At project closeout, provide to Owner or Owners Representative a copy of the manufacturer's limited warranty outlining its terms and conditions.

1. Duration: Lifetime limited warranty extended to original owner.

B. Free from defects in material and workmanship for "lifetime" of ownership. Installation must be per manufacturer's guidelines. "Lifetime" means as long as purchaser of column owns the structure to which column is attached".

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable Manufacturer: HB&G, which is located at: P. O. Box 589 ; Troy, AL 36081; Toll Free Tel: 800-264-4424; Tel: 334-566-5000; Fax: 334-566-4629; Email: info@hbgcompanies.com; Web: www.hbgcolumns.com.

B. Column design and specification is based on HB&G PermaCast Columns, and the terminology used may include reference to that manufacturer's or to other manufacturer's products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

C. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

1. Fiber-reinforced polymer shall be class A – Flame retardant; in accordance with ASTM E-84, flame spread <25, smoke developed <450.

2. Provide styles and sizes per section 1.06 above.

3. Shaft thickness shall be 1/8" to 1/4" depending on size.

4. Color: Shall be white (L Value 100).

5. Provide PermaCast PermaFlashing and installation kit to close tops of capitals in locations where the capitals are wider than the wall/roof/gable construction above.

2.02 ACCESSORY MATERIALS

A. Construction Adhesive: Non-acetone based exterior grade.

1. Use at top and bottom of shaft.

2. Use at top of cap and bottom of base prior to nailing or screwing to soffit and substrate.

3. Use to affix neck molding to shaft of square columns, prior to screwing or nailing the molding

in place.

B. Caulk: Use to cover holes of nails or screws in molding for square columns.

C. Molding for Columns: As indicated on the drawings.

D. Hardware:

1. Bottom Anchors: Corner irons.
2. Anchor Fasteners: Deck screws.
3. Anchor Fasteners: Concrete anchors.
4. Anchor Fasteners: Hollow wall anchors.
5. Cap and Base Fasteners: Screws.
6. Cap and Base Fasteners: Nails.
7. Molding Fasteners: Screws.
8. Molding Fasteners: Finishing nails.

2.03 FINISH

A. Primer:

1. Oil Based Primer: One light, even coat of top quality exterior oil-based primer.

B. Finish Coat:

1. Oil Based Finish: Three light, even coats of high quality exterior oil-based paint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Check opening height before ordering columns.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. If attaching handrails or corner iron to column, pre-drill holes before applying screws.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Plumb and level, with 100 percent of bottom contacting substrate and 75 percent of top contacting soffit. Center load over shaft and evenly distribute around bearing surface.

C. Installing contractor shall field measure opening. If column is too long, shorten from the bottom end

only. Use an abrasive saw. Fine trim top and bottom with a rasp to assure flat surface contact.

D. Drill pilot holes before nailing cap and base in place.

E. Mark and drill holes in floor surface and column shaft for corner irons.

F. Slip base over top of column shaft and neck mold and allow to slide down to base of shaft slip cap over neck of shaft and allow to rest on neck mold until set into place.

G. Apply construction adhesive (PL-500) to top and bottom surfaces of shaft. Note: Before adhesive sets up, remove excess with mineral spirits.

H. Put assembly in place and align. Make sure load is centered over column shaft, and evenly distributed around the bearing surface.

I. Fasten corner irons to floor surface in accordance with manufacturer's recommendations.

J. Apply construction adhesive to top of cap, press against structure above, and screw in place in accordance with manufacturer's recommendations.

K. Apply construction adhesive to bottom of base and nail or screw into floor surface using applicable anchors required for floor surface material (wood, concrete, brick, masonry, etc.). Anchor size and type per manufacturer's recommendations.

L. Prime and finish paint in accordance with manufacturer's recommendations and Section 099000 – Painting.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 071000 – DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of each type of dampproofing is indicated on drawings.

B. Following types and applications of work are specified in this section:

1. Cold-applied asphalt emulsion dampproofing.

C. Similar work used as exposed finish is excluded by definition and, if required, is specified as waterproofing, vapor retarder, roofing, flooring, special coating, or another appropriate category.

1.03 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete
B. Section 042000 – Unit Masonry

1.04 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Submit manufacturer's technical product data, installation instructions, and recommendations for each dampproofing material required. Include data substantiating that materials comply with specified requirements.

C. Warranty: Submit a sample warranty identifying the terms and conditions stated in Warranty article.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator shall be experienced in applying the same or similar materials.

B. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship is approved by Architect.
3. Rebuild mock-up area as required to produce acceptable work.

D. Installer Qualifications: A firm which has specialized for not less than three years in installation of types of dampproofing required for project and which is acceptable to manufacturer of primary materials.

1.06 PRE-INSTALLATION MEETINGS

A. Pre-Installation Conference: Prior to beginning work, convene a conference to review conditions, installation procedures, schedules and coordination with other work.

B. Convene minimum two weeks prior to starting work of this section.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original, factory-sealed, unopened containers bearing manufacturer's name and label intact and legible with following information.

1. Name of material.
2. Manufacturer's stock number and date of manufacture.

B. Store materials in protected and well ventilated area. Handle materials to avoid damage.

1.08 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

B. Weather: Proceed with dampproofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations. Do not apply when surface temperature or weather conditions conflict with manufacturer's published requirements.

C. Ventilation: Provide adequate ventilation to prevent accumulation of hazardous fumes during application of solvent-based components in enclosed spaces and maintain ventilation until coatings have thoroughly cured.

D. Keep flammable products away from spark or flame. Do not allow the use of spark producing equipment during application and until all vapors have dissipated. Post "NO SMOKING" signs.

E. Maintain work area in a neat and orderly condition, removing empty containers, rags, and rubbish daily from the site.

1.09 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

A. Warranty: Provide manufacturer's standard limited material warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. General: Provide bituminous dampproofing materials which comply with the following requirements, or provide other similar products which are certified in writing by manufacturer of primary dampproofing materials to be superior in performance for application indicated.

B. Cold-Applied Asphalt Emulsion Dampproofing:

1. Asphalt Emulsion: Manufacturer's standard asphalt and water emulsion coating, recommended for below-grade exterior and for above-grade interior applications to either damp (green) or dry substrates, compounded to penetrate substrate and built to moisture-resistant coating.

2. Provide semi-fibrated type semi-mastic asbestos-free emulsion; ASTM D 1227, Type II, except containing non-asbestos fibrous reinforcement and filler materials.

C. Acceptable Manufacturer: KARNAK, which is located at: 330 Central Ave.; Clark, NJ 07066; Toll Free Tel: 800-526-4236; Tel: 732-388-0300; Fax: 732-388-9422; Email: request info (info@karnakcorp.com); Web: https://www.karnakcorp.com.

D. Bond-Coat Type: Where asphalt emulsion dampproofing is indicated as bond coat for bonding of plaster or other materials to substrate, provide tacky-surfaced material recommended by manufacturer for application shown.

2.02 DAMPROOFING MATERIALS

A. 86AF Fibered Trowel Mastic: Trowel grade, manufactured from a blend of selected asphalts, fibers, stabilizers, fillers and solvents.

1. Dries to a tough, flexible, durable finish and will resist variations in temperature and conditions.
2. Excellent resistance to most acids, alkalies, and salts.
3. ASTM D4586, Type I (Non-Asbestos).
4. Federal Specification SS-C-153, Type I (except Asbestos-Free).
5. Coverage Rate: 5 to 6 gallons per 100 square feet.
6. Solids by Weight: 74 percent.
7. Solids by Volume: 67 percent.
8. Color: Black.
9. Permeance: 0.25 perms.
10. Cure Time: 24 to 48 hours at 77 degrees F and 50 percent Relative Humidity.
11. Service Temperature (Cured Film): 15 to 160 degrees F.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBSTRATE

A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.

C. Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.

D. Install separate flashings and corner protection stripping as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with details shown and manufacturer's recommendations. Give particular attention to requirements at building expansion joints, if any.

E. Prime substrate as recommended by prime materials manufacturer.

F. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and

conductors. Prevent spillage and migration onto other surfaces of work, by masking or otherwise protecting adjoining work.

3.02 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of work.

B. Asphalt Emulsion on Exterior and Interior Surfaces:

1. Apply coat of liquid asphalt emulsion dampproofing material by brushing or spraying at a rate of 1.5 to 2.5 gals. per 100 s.f., depending upon substrate texture, as required to produce uniform dry film thickness of not less than 15 mils. Apply in 2 coats if necessary to obtain required thickness, allowing time for complete drying between coats.

2. Apply coat of semi-fibrated, (in areas of brick or block foundations) semi-mastic, asphalt emulsion dampproofing materials, by brushing or spraying at a rate of 5.0 gal. per 100 s.f., to produce uniform, dry film thickness of not less than 30 mils.

C. Dampproof Protection Course:

1. General: Where indicated, install protection course of type indicated, over completed and cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attachment of protection materials. Support with spot-application of plastic cement where not otherwise indicated.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 071326 – SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 01 General Requirements, apply to the work of this section.

1.02 SUMMARY

A. The work of this section includes, but is not limited to, the following:

1. Rubberized asphalt sheet membrane waterproofing system
2. Prefabricated drainage composite
3. Protection board

B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 033000 – Cast-In-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 071000 – Dampproofing
4. Section 076000 – Flashing and Sheet Metal
5. Section 079200 – Joint Sealants

C. If designated as a LEED project, then also:

1. Section 013563 – LEED Requirements
2. Section 017419 – Construction Waste Management

1.03 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM):

C 836	Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
D 412	Standard Test Methods for Rubber Properties in Tension
D 570	Standard Test Method for Water Absorption of Plastics
D 882	Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
D 903	Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
D 1876	Standard Test Method for Peel Release of Adhesives (T-Peel)
D 1970	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
D 3767	Standard Practice for Rubber - Measurements of Dimensions
D 5385	Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
E 96	Standard Test Methods for Water Vapor Transmission of Materials
E 154	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.

B. Samples: Submit representative samples of the following for approval:

1. Sheet membrane
2. Protection board
3. Prefabricated drainage composite

1.05 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer: A firm which has at least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
2. Protect mastic and adhesive from moisture and potential sources of ignition.
3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays but minimize on-site storage.

C. Safety and Handling: Users must read and understand the product label and Safety Data Sheets (SDS's) for each system component before use. All users must acquaint themselves with this information prior to working with the material. Carefully read detailed precaution statements on the product labels and SDS's before use.

1.07 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.08 WARRANTY

A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Membrane Waterproofing System: BITUTHENE® System 4000 Membrane as manufactured by GCP Applied Technologies; a self-adhesive, cold-applied composite sheet consisting of a thickness of 0.056 in. of rubberized asphalt and 0.004 in. of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet, which is removed during installation and no special adhesive or heat shall be required to form laps.

B. Provide membrane with the following physical properties:

PHYSICAL PROPERTIES FOR BITUTHENE® SYSTEM 4000 MEMBRANE:

Property	**Test Method**	**Typical Value**
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	60 mils (1.5mm) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -32°C (-25°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412[1]	2240 kPa (325 psi) minimum
Tensile Strength, Film	ASTM D 882[1]	34.5 MPa (5,000 psi) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412[1]	300% minimum
Crack Cycling at -32°C (-25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Shear	ASTM D 1002[2]	89 N (20 lbs.) minimum
Peel Strength	ASTM D 903	1926 N/m (11 lbs/in.) minimum
Puncture Resistance, Membrane	ASTM E 154	222 N (50 lbs) minimum
Resistance to Hydrostatic Head	ASTM D 5385	>70 m (>230 ft) of water
Permeance	ASTM E 96, Section 12 – Water Method	<0.1 perms
Water Absorption	ASTM D 570	0.1% maximum

Footnotes:
1. *The test is run at a rate of 50 mm (2 in.) per minute.*
2. *The test is run at a rate of 100 mm (4 in.) per minute.*

2.02 ANCILARY PRODUCTS

A. Prefabricated Drainage Composite: HYDRODUCT® 220 and/or HYDRODUCT® 660 Drainage Composite as manufactured by GCP Applied Technologies to promote positive drainage while serving as a protection course.

B. Protection Board:

1. Expanded Polystyrene Protection Board: 25 mm (1 in.) thick for vertical applications with the following characteristics. Adhere to waterproofing membrane with BITUTHENE® Protection Board Adhesive.

   a. Normal Density: 16 kg/m3 (1.0 lb/ft3)
   b. Thermal Conductivity, K factor: 0.24 at 5°C (40°F), 0.26 at 24°C (75°F)
   c. Thermal Resistance, R-Value: 4 per 25 mm (1 in.) of thickness.

2. Asphalt Hardboard: A premolded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 3 mm (0.125 in.) thick hardboard on horizontal surfaces not receiving steel reinforced slab. Where steel reinforcing bars are to be used, apply two layers of 3 mm (0.125 in.) thick hardboard or one layer of 6 mm (0.25 in.) thick hardboard.

C. Waterstop: AdcorTM hydrophilic waterstop as manufactured by GCP Applied Technologies for non-moving concrete construction joints.

D. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION OF SUBSTRATES

A. Refer to manufacturer’s literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.

B. Cast-In-Place Concrete Substrates:

1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).
2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
4. Remove scaling to sound, unaffected concrete and repair exposed area.
5. Grind irregular construction joints to suitable flush surface.

C. Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.

D. Wood Substrates: Apply waterproofing membrane over securely fastened sound surface. All joints and fasteners shall be flush to create a smooth surface.

E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.03 INSTALLATION

A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:

1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.
2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.
3. Seal daily terminations with troweled bead of mastic.
4. Apply protection board and related materials in accordance with manufacturer's recommendations.

3.04 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072100 – BUILDING INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of building insulation as indicated on the drawings and specified herein.

1. This Section includes the following:
   a. Continuous rigid board insulation at exterior wall construction and under metal wall panels.
   b. Rigid board insulation at perimeter foundation walls.
   c. Rigid board insulation at underside of floor slabs.
   d. Fibrous blanket insulation for thermal purpose, where indicated
   e. Miscellaneous batt insulation to maintain continuity of building thermal barrier
   f. Protective cover over insulation board prior to placement of backfill or concrete cover.
   g. Nailboard insulation used for roof decks.
   h. Roof insulation used for flat roof installations.

B. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

C. Related Sections include the following:

1. Section 033000 – Cast-in-Place Concrete Work
2. Section 042000 – Unit Masonry
3. Section 061000 – Rough Carpentry
4. Section 072113 – Ultra Wall Insulation and Air Barrier – for rigid board insulation at masonry cavity wall construction.
5. Section 078400 – Firestopping – for fire-stop and smoke-stop materials at voids around penetrations through fire-rated and smoke barrier wall and roof construction assemblies.
6. Section 084113 – Aluminum Entrances and Storefronts – for miscellaneous batt insulation required at periphery of storefront framing system.
7. Section 085113 – Aluminum Windows – for miscellaneous batt insulation required at periphery of windows.
8. Section 092900 – Gypsum Wall Board – for sound attenuation insulation, metal stud and drywall partition construction.
9. Section 095000 – Acoustic Ceiling Systems – for ceilings to receive thermal lay-in insulation.

1.02 QUALITY ASSURANCE

A. Standards: Comply with standards specified in this section and as listed in Section 014219.

B. Manufacturers:

1. Insulation systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of insulation materials. Obtain insulation material through one source from a single manufacturer. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five years.

C. Installers:

1. The installation work of this section shall be performed by one entity, an experienced contractor that employs installers and supervisors who are trained and authorized by manufacturer, with a minimum five years' record of successful installations on projects of similar scope.

D. Reference Standards:

1. American Society for Testing and Materials (ASTM):

a. ASTM A272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
b. ASTM C177: Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
c. ASTM C518: Steady-State Thermal Transmission Properties by Means of The Heat Flow Meter.
d. ASTM C578: Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.
e. ASTM C665: Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
f. ASTM D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
g. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
h. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.
i. ASTM E119: Standard Test Methods for Fire Tests of Building Constructions and Materials.
j. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
k. ASTM E2178: 11 Standard Test Method for Air Permeance of Building Materials.
l. ASTM E2357: 11 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

2. International Code Council Evaluation Service (ICC-ES):

a. AC 71: Acceptance Criteria for Foam Plastic Sheathing Panels Used as Water Resistive Barriers.

3. National Fire Protection Association (NFPA):

a. NFPA 285: Standard Fire Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

4. Federal Specifications (FS):

a. FS HH-I-521E: Insulation Blankets, Thermal Fiber, for Ambient Temperatures.

1.03 SUBMISSIONS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

B. Product Data: Manufacturers' data on each type of product furnished including:

1. Preparation instructions and recommendations.
2. Technical data and tested physical and performance properties of products.
3. Storage, handling requirements, and recommendations.

C. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values (aged values for plastic

insulations), densities, compression strengths, fire performance, perm ratings, water absorption ratings, and similar properties.

D. Samples for Verification:

1. Submit, to the job site, 6” x 6” samples of each type and thickness of insulation.
2. Submit appropriate sample of loose fill insulation.
3. Submit manufacturer’s verification that rigid insulation contains at least 20% combined post-consumer and post –industrial recycled content.
4. Submit manufacturer’s verification that batt insulation contains at least 30% combined post-consumer and post –industrial recycled content.
5. Submit manufacturer’s verification that cellulose insulation contains at least 85% combined post-consumer and post –industrial recycled content.

E. Mock-Up: If requested, provide a mock-up of materials proposed for use for review of workmanship. Accepted mock-ups may remain in place.

F. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing work of this section. Agenda shall include materials proposed for use, sequence of construction and coordination with installation of adjacent and covering materials.

G. Certificates: Submit documentation signed by Manufacturer that products meet Quality Assurance Certification requirements of this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in their original, unopened packages or containers; labels shall be intact, identifying contents, manufacturer, brand name, thermal values and applicable standards. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources.

B. Store all materials in a single location protected from weather, moisture, and open flame or sparks in dry locations with adequate ventilation, and in such a manner to permit easy access for inspection and handling.

1. In the event the extruded polystyrene insulation board becomes wet, wipe dry prior to installation.

2. In the event the batt or blanket insulation becomes wet, remove it from the jobsite.

C. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of other trades.

D. Comply with manufacturer's written recommendations for handling, storage, and protection during installation.

E. Warning: Rigid insulation is combustible and may constitute a fire hazard; adequate protection shall be provided in accordance with National Fire Protection Association (NFPA) standards or the authority having jurisdiction.

F. Cover and protect insulation with light colored or white opaque covering while in storage; sunlight causes discoloration and deterioration that impairs adhesive bonding.

1.06 FIELD CONDITIONS

A. Ambient Conditions:

1. Apply products within the range of ambient and substrate temperatures recommended by manufacturer.

2. Protect substrates from environmental conditions that affect insulation performance.

1.07 WARRANTY

A. Provide manufacturer's standard limited warranty against manufacturing defects.

B. Provide Manufacturer's Lifetime Limited Warranty for ASTM C578 performance properties including retaining 90% thermal performance for the life of the product.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. General: Design is based on insulating materials as specified on drawings. The terminology used may include reference to specific manufacturers' proprietary products. Such reference shall be construed only as establishing the quality of the materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

B. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

C. Flame Spread & Smoke Developed Rating: All insulation materials shall have a flame spread rating of less than 25 and smoke developed not to exceed 450, in accordance with ASTM E-84.

2.02 EXTERIOR WALL SHEATHING CONTINUOUS INSULATION

A. Basis-of-Design has been specified around standard products as manufactured by Owens Corning®, www.owenscorning.com/insulation/commercial. Provide the named product or a comparable product similar or equal to "FOAMULAR® 150 XPS", extruded polystyrene insulation panels conforming to ASTM C578.

B. Description: Provide continuous extruded polystyrene insulation (sheathing), unfaced. Each insulation board must be labeled with manufacturer's name, product brand name, ASTM material specification reference, and identification of the third-party inspection agency used for building code qualification.

C. Performance Data:

1. Type X per ASTM C578 certified by independent third-party testing agency.

2. Compressive Strength: 15 psi, minimum per ASTM D1621.

3. Thermal Resistance (180 day real-time aging as mandated by ASTM C578, measured per ASTM C518 at mean temperature of 75F): R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.

4. Water Absorption (ASTM C272): Maximum.0.30 percent by volume.

5. Surface Burning Characteristics (ASTM E84): Flame spread less than 25; smoke developed less than 450, certified by independent third-party testing agency.

D. Materials:

1. Compliance certified by independent third party such as GREENGUARD Indoor Air Quality Certified® and/or GREENGUARD Gold℠.

2. Contains no HCFCs.

3. Zero ozone depleting blowing agent that has warming potential (100 years) of less than 750.

4. Recycled Content: Minimum 20%, certified by independent third party such as SCS Global Services.

5. Provide R-5 per inch of thickness; 1-1/2" thickness minimum at exterior wall locations or as indicated on the drawings thick; 48"x96"; square edge.

E. Fasteners:

1. Screw with Air & Water Sealing Washer: Provide preassembled screw and stress plate fasteners recommended by their manufacturer for securing extruded polystyrene (XPS) continuous insulation. Polymer or other corrosion-protected, coated steel screw fasteners for anchoring to sheathing and metal stud wall framing. Fastener length and size based on wall sheathing thickness and fastener manufacturer recommendation.

F. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

2.03 RIGID PERIMETER AND UNDER SLAB INSULATION

A. Basis-of-Design has been specified around standard products as manufactured by Owens Corning®, www.owenscorning.com/insulation/commercial. Provide the named product or a comparable product similar or equal to "FOAMULAR® 250 XPS", extruded polystyrene insulation panels conforming to ASTM C578.

1. Comparable similar or equal to product: DuPont™ Styrofoam™ Brand Square Edge Insulation as manufactured by DuPont de Nemours Inc.

B. Description: Provide continuous extruded polystyrene insulation unfaced. Each insulation board must be labeled with manufacturer's name, product brand name, ASTM material specification reference, and identification of the third-party inspection agency used for building code qualification.

C. Performance Data:

1. Type IV per ASTM C578 certified by independent third-party testing agency.

2. Compressive Strength: 25 psi, minimum per ASTM D1621.

3. Thermal Resistance (180 day real-time aging as mandated by ASTM C578, measured per ASTM C518 at mean temperature of 75F): R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.

4. Water Absorption (ASTM C272): Maximum.0.30 percent by volume.

5. Surface Burning Characteristics (ASTM E84): Flame spread less than 25; smoke developed less than 450, certified by independent third-party testing agency.

D. Materials:

1. Compliance certified by independent third party such as GREENGUARD Indoor Air Quality Certified® and/or GREENGUARD Gold℠.

2. Contains no HCFCs.

3. Zero ozone depleting blowing agent.

4. Recycled Content: Minimum 20%, certified by independent third party such as SCS Global Services.

5. Provide R-5 per inch of thickness; 2” thickness minimum at foundation wall and under slab locations or as indicated on the drawings thick; 48”x96”; square edge.

E. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

2.04 FIBERGLASS BLANKET INSULATION

A. Basis-of-Design has been specified around standard products as manufactured by Owens Corning® Insulating Systems, Toledo, OH 43659, www.owenscorning.com. Provide the named product or a comparable product similar or equal to “PINK Next Gen™ Fiberglas™ Insulation”.

1. Comparable similar or equal to product:

   a. CertainTeed Corporation.
   b. Johns Manville Corporation.

B. PINK Next Gen™ Fiberglas™ Insulation Unfaced Batt Insulation: ASTM C 665, Type I, preformed formaldehyde free glass fiber batt type, unfaced. Includes Unfaced PINK Next Gen™ Fiberglas™, Unfaced PINK Next Gen™ Fiberglas™ Sonobatts® Insulation and PINK Next Gen™ Fiberglas™ Sound Attenuation Batts (SAB) Insulation.

1. Noncombustible per ASTM E 136.
2. Flamespread less than 25, smoke developed less than 50 per ASTM E84.
3. ICC Building Code Construction Classification: All types.
4. Water vapor sorption, Maximum by weight: not more than 5 percent.

C. PINK Next Gen™ Fiberglas™ Insulation Kraft Faced Batt Insulation: ASTM C 665, Type II, Class C preformed formaldehyde free glass fiber batt type, Kraft paper faced one side. Includes Kraft faced PINK Next Gen™ Fiberglas™ Insulation, Kraft faced PINK Next Gen™ Fiberglas™ Sonobatts® Insulation and PINK Next Gen™ Fiberglas™ Insulation ProPink FastBatt Insulation.

1. ICC Building Code Construction Classification: III, IV, V.
2. Perm Rating: 1 perm maximum per ASTM E96.

D. Accessories: Provide accessories per insulating system manufacturer’s recommendations, including the following:

1. Tape: Polyethylene self-adhering type for Kraft faced insulation and bright aluminum self-adhering type for foil faced insulation.
2. Insulation Fasteners: Impale clip of galvanized steel; type recommended by insulation manufacturer for particular use intended.
3. Mechanical Insulation Fasteners: FM approved, corrosion resistant, size required to suit application.
4. Wire Mesh: Galvanized steel, hexagonal wire mesh.
5. Spindle Fasteners: Corrosion-resistant wire spindles.

6. Ventilation Baffles: Formed plastic, metal, or cardboard sized to fit full width of rafter spaces.

E. Performance Data:

1. Wood Frame Construction - Walls, R-Value: Per ASTM C518.

   a. R-11, 3 1/2 inch thickness, 15 inch or 23 inch width, 48 inch or 93 inch length.
   b. R-13, 3 1/2 inch thickness, 15 inch or 23 inch width, 48 inch or 93 inch length.
   c. R-15, 3 1/2 inch thickness, 15 inch or 23 inch width, 93 inch length.
   d. R-19, 6 1/2 inch thickness, 15 inch or 23 inch width, 48 inch or 93 inch length.
   e. R-21, 5 1/2 inch thickness, 15 inch or 23 inch width, 93 inch length.

2. Wood Frame Construction - Roof/Floor/Ceiling, R-Value: Per ASTM C518.

   a. R-19, 6 1/2 inch thickness, 15 inch or 19-1/4 inch or 23 inch width, 48 inch or 93 inch length.
   b. R-22, 6 3/4 inch thickness, 15 inch or 23 inch width, 48 inch length.
   c. R-25, 8 inch thickness, 15 inch or 23 inch width, 48 inch length.
   d. R-30C, 8 1/4 inch thickness, 15-1/2 inch or 23-3/4 inch width, 48 inch length.
   e. R-30, 10 inch thickness, 16 inch or 19-1/4 inch or 24 inch width, 48 inch length.
   f. R-38C, 10 1/4 inch thickness, 15-1/2 inch or 23-3/4 inch width, 48 inch length.

3. Metal Frame Construction, R-Value for Batt Insulation: Per ASTM C518.

   a. R-8, 2 1/2 inch thickness, 16 inch or 24 inch width, 96 inch length.
   b. R-11, 3 1/2 inch thickness, 16 inch or 24 inch width, 48 inch or 96 inch length.
   c. R-13, 3 1/2 inch thickness, 16 inch or 24 inch width, 48 inch or 96 inch length.
   d. R-15, 3 1/2 inch thickness, 16 inch or 24 inch width, 96 inch length.
   e. R-19, 6 1/2 inch thickness, 16 inch or 24 inch width, 48 inch or 96 inch length.
   f. R-21, 5 1/2 inch thickness, 16 inch or 24 inch width, 96 inch length.

F. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

2.05 NAILABLE RIGID ROOF INSULATION

A. Basis-of-Design has been specified around products as manufactured by Johns Manville or Architect approved equal. Provide the named product or a comparable product similar or equal to “Nailboard”, 4" overall thickness (R-20.5) closed cell polyisocyanurate foam core insulation board (ENERGY 3®) with 5/8” thick OSB.

B. Performance Data: (ENERGY 3® Foam Layer Only)

1. Type V per ASTM C1289.

2. Insulation Board Compressive Strength: 25 psi, minimum per ASTM D1621.

3. Long Term Thermal Resistance (LTTR): 20.5 R-Value, determined in accordance with CAN/ULC S770 at 75 deg F.

4. Water Absorption (ASTM C209): Maximum. 1.0 percent by volume.

5. Foam Core Surface Burning Characteristics (ASTM E84): Flame spread 20-30; smoke developed 55-250, certified by independent third-party testing agency.

C. Materials:

1. Orientated Strand Board (OSB): 5/8” thick with 1/8” routed edges.

2. ENERGY 3® closed cell polyisocyanurate foam core.

3. Standard board size to be 4’ x 8’ x 4" thick with an averaged R-Value of 20.5.

4. Rigid board shall be UL class A fire rated.

5. OSB must contain no urea-formaldehyde resins.

D. Fasteners:

1. All Nailboards must be mechanically attached with JM-approved fasteners Nail-Lok™ SD and Nail-Lok™ WD.

E. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

2.06 ROOF INSULATION BOARD

A. Basis-of-Design has been specified around products as manufactured by Johns Manville or Architect approved equal. Provide the named product or a comparable product similar or equal to “ENERGY 3®" 2” overall thickness (R-11.4) closed cell polyisocyanurate foam core insulation board or thickness as indicated on the drawings.

B. Performance Data: (ENERGY 3® Foam Layer Only)

1. Type II, Class , Grade 3 per ASTM C1289.

2. Insulation Board Compressive Strength: 25 psi, minimum per ASTM D1621.

3. Long Term Thermal Resistance (LTTR): 5.7 per inch, determined in accordance with CAN/ULC S770 at 75 deg F.

4. Water Absorption (ASTM C209): Maximum. 1.0 percent by volume.

5. Foam Core Surface Burning Characteristics (ASTM E84): Flame spread 20-30; smoke developed 55-250, certified by independent third-party testing agency.

C. Materials:

1. Standard board size to be 4’ x 8’ x 2" thick with an averaged R-Value of 11.4.

2. Rigid board shall be UL class A fire rated.

D. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

2.07 MATERIAL REQUIREMENTS

A. Batt / Blanket Insulation:

1. General Thermal Use Insulation: Preformed glass fiber, ASTM C665, Type I, unfaced without integral vapor barrier, friction fit type, 3-1/2” thick, with a thermal resistance (R-value) of R-11, unless thickness and R value are noted otherwise.

2. Wall Insulation: Types as called for on the drawings, preformed glass fiber, ASTM C665, Type I, unfaced without integral vapor barrier, friction fit type or ASTM C665, Type II, Class C, with Kraft-faced integral vapor barrier, as indicated on drawings, 6 1/4" thick, and a thermal resistance (R-value) of R-19, unless thickness and R value noted otherwise.

3. Ceiling Insulation: Preformed glass fiber, ASTM C665, Type I, unfaced without integral vapor barrier, friction fit type, 6 1/4" thick with a thermal resistance (R-value) of 19; 12" thick, and a thermal resistance (R-value) of R-38, unless thickness and R value noted otherwise.

4. Fire-Hazard Classification: When tested in accordance with ASTM E84.

   a. Concealed Installations:

      1) Flame Spread Rating: 25 maximum.
      2) Smoke Development Rating: 50 maximum.

   b. Exposed installations:

      1) Flame Spread Rating: 75 maximum.
      2) Smoke Development Rating: 450 maximum.

B. Staples: Electroplated or galvanized steel wire, type and size as recommended for application.

C. Wire-Up: Utilize 16 or 18 gauge line wire run diagonally or perpendicular to insulation every 18 to 24 inches.

D. Impaling Pin: Utilize impaling pins welded or fastened with adhesive. Impale insulation on anchor and secure with washer.

E. Miscellaneous Batt Insulation: Preformed glass fiber, ASTM C665, Type I, un-faced without integral vapor barrier membrane, field cut to appropriate size and thickness as required or indicated on Contract Drawings.

F. Protective Board Covering: 1/8" thick biodegradable hardboard, 1/4" minimum thickness of wood fiberboard, or other protective covering as approved by the Architect.

2.08 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of the work of this section, shall be as selected by the Contractor, subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Carefully examine all the areas and conditions under which work of this section will be installed. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation in writing before proceeding. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Insure that work of all preceding trades is completed prior to starting work of this Section. Verify adjacent materials are dry and ready to receive insulation.

C. Verify that wall, opening framing, bridging and structural bracing, and other framing support members and anchorage have been installed per requirements of the Project.

D. Installation of products specified in this Section constitutes acceptance of existing conditions and assumption of responsibility for satisfactory performance.

E. Verify that grade, excavation, fill, utilities penetrations, concrete accessories, and vapor retarding membrane have been installed per requirements of the Project.

F. Verify adjacent waterproofing membrane and materials are dry and ready to receive insulation.

G. Verify mechanical and electrical services within walls have been tested and inspected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Insure surfaces are in uniform plane; true to dimensions; and free of waxes, oily films, grease, loose mortar chips, other items detrimental to installation.

3.03 INSTALLATION - GENERAL

A. Except as otherwise specifically directed by the Architect, install all building insulation in the size and thickness specified, in strict accordance with the manufacturer's instructions.
B. Install rigid insulation to maintain continuous and complete thermal protection for building spaces and elements.

C. Cut and trim rigid insulation; by means of saw, knife or other sharp tool, to neatly fit spaces and around mechanical, electrical and other items which protrude through plane of insulation. Butt edges and ends tight. Use only rigid insulation free of broken or chipped edges.

D. Installation of Perimeter Insulation:

1. Secure rigid insulation on perimeter foundation wall with adhesive, using “spot or ribbon method”, in accordance with the insulation manufacturer’s recommendations.

2. Place insulation horizontally and install continuously.

3. Stagger vertical joints of insulation, except free ends over line of control joints.

4. Extend insulation down below finish grade 48” or to top of footing, whichever is less, unless noted or indicated otherwise.

5. Do not allow insulation to be displaced during backfilling operation.

6. Immediately following application of insulation boards, place protective board covering over exposed insulation surfaces and adhesive secure boards in accordance with manufacturer's instructions. Install boards horizontally or vertically from base of insulation to top of insulation. Butt board joints tight, stagger from insulation joints.

E. Installation - Under Slab on Grade:

1. Place rigid insulation under slabs on grade after base for slab on grade has been compacted.

2. Extend insulation in 24” from the outside edge of slab unless noted or indicated otherwise.

3. Prevent insulation from being displaced or damaged while placing vapor barrier and pouring slabs.

F. Installation of Batt / Blanket Insulation:

1. Install unfaced batt/blanket insulation in accordance with manufacturers instructions, friction fitted between framing members in walls, ceilings and floors.

2. Install faced batt/blanket insulation in accordance with manufacturers instructions, with facing having formed flanges at the edges for either face or inset stapling at maximum 6” o.c. or taping to framing members. Install factory applied vapor-retarding membrane facing warm side of building spaces.

3. Install insulation without gaps or voids, lapping ends and side flanges. Do not compress insulation.

4. Trim insulation neatly to fit tight in spaces and tight to exterior side of mechanical and electrical services within the plane of the insulation.

5. Tape seal butt ends, lapped flanges, and punctures, tears and cuts in membrane.

G. Installation of Miscellaneous Batt Insulation:

1. Coordinate with other Sections and install fibrous insulation around exterior doorframes, window frames, roof expansion joints, roof and wall penetrations, and other voids to maintain continuity of building thermal barrier.

2. Insulate all miscellaneous gaps or voids to maintain thermal continuity of building.

H. Installation of Roof Insulation:

1. Verify that surfaces and site conditions are ready to receive work.

2. Verify that deck is supported and secured.

3. Verify that deck is clean and smooth, free of depressions, irregularities, or projections, properly sloped to drains.

4. Verify that deck surfaces are dry and free of dirt and debris. (Verify flutes of metal deck are clean and dry).

5. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set and wood cant strips, wood nailing strips and reglets are in place.

6. Start of work means installer accepts existing substrate.

7. Protect building surfaces against damage from roofing work.

8. Verify that metal deck units are properly secured in place.

3.04 EXTERIOR WALL SHEATHING CONTINUOUS INSULATION INSTALLATION

A. Verify manufacturer recommended cure time for air and water barrier system before installing

continuous insulation board.

B. Install extruded polystyrene (XPS) insulation boards over the exterior gypsum sheathing and air & water resistive barrier layer in accordance with manufacturers' written recommendations.

C. Install XPS insulation board in maximum sizes to minimize joints.

D. Locate joints square to framing members. Center joints over framing. Provide additional framing as necessary.

E. Stagger joints a minimum of one stud space from adjacent joints.

F. Insulation board edges shall be butted together tightly and fit around openings and penetrations. Install square edges to fit square and tight.

G. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.

H. Apply single layer of insulation boards to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

I. Fasten XPS insulation to exterior face of steel stud wall framing and exterior sheathing using screw and air & water sealing washer and compatible adhesive per manufacturer's written instructions.

    1. Screw with Air & Water Sealing Washer:

        a. Install through XPS insulation into sheathing and stud with self-drilling screws using a standard drill with a variable clutch adjustment and appropriate adapter or auto-feed fastening system.
        b. Do not attach with impact driver.
        c. Drive fasteners so the washer is tight and flush with insulation surface but do not countersink.
        d. Fastener spacing shall be evenly distributed and the minimum necessary per job site conditions as required by Insulation & Fastener Manufacturers to hold the continuous insulation in place until cladding attachment system can be installed to permanently secure the insulation board in accordance with the cladding requirements.
        e. Two-inch diameter pronged fasteners can bridge between adjoining board edges.

    2. Compatible Adhesive:

        a. Apply compatible adhesive to sheathing & air barrier, per adhesive manufacturer, air barrier manufacturer, and insulation manufacturer recommendations.
        b. Install XPS insulation in adhesive while wet.
        c. Hold insulation securely in place until adhesion is satisfactory.
        d. Application rate and spacing shall be evenly distributed and minimum necessary per jobsite conditions as required by Insulation & Adhesive Manufacturers to hold the continuous insulation in place until cladding attachment system can be installed to permanently secure the insulation board in accordance with the cladding requirements.

J. Fastening requirements may be revised per job site conditions if insulation board is being installed at the same time as the cladding attachment system that will serve to secure insulation board to the substrate. Contractor must receive written confirmation from the Architect before altering fastener requirements.

K. Install exterior cladding as soon as possible, best within 60 days.

3.05 RIGID PERIMETER AND UNDER SLAB INSULATION INSTALLATION

A. Verify all membrane testing has been satisfactorily completed prior to beginning installation.

B. Verify vapor retarding membrane is installed correctly if required prior to installation of extruded polystyrene insulation.

C. Verify below grade gas retarding membrane is installed correctly if required prior to installation of extruded polystyrene insulation.

D. Install extruded polystyrene (XPS) insulation boards over the drainage aggregate and vapor retarding membrane in accordance with manufacturers' written recommendations.

E. Install XPS insulation board in maximum sizes to minimize joints.

F. Locate joints square to structure.

G. Install insulation with long edges of XPS in continuous straight lines with edge joints staggered.

H. Stagger joints in subsequent layers.

I. Insulation board edges shall be butted together tightly and fit around openings and penetrations. Install square edges to fit square and tight.

J. Install in one or more layers to meet thickness indicated to envelop entire area to be insulated.

K. Apply single layer of insulation boards to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

L. Install reinforced slab immediately after installation of insulation as described in Section 033000.

3.06 FIBERGLASS BLANKET INSULATION INSTALLATION

A. Comply with manufacturer's installation instructions and ASTM C1320. Do not use unfaced insulation in exposed applications where there is potential for skin contact and irritation. Kraft and standard foil facings will burn and must not be left exposed. The facing must be installed in substantial contact with the unexposed surface of the ceiling, wall or floor finish. Protect facing from any open flame or heat source.

B. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.

    1. Do not install insulation on top of or within 3 inches of recessed light fixtures unless the fixtures are approved for such use.

C. In crawl spaces and where the underside of floors are exposed to unconditioned space, insulation shall fill the cavity or be installed in contact with the underside of the decking. If vapor retarder is required by local code, a Kraft vapor retarder must be in contact with a 15-minute thermal barrier, typically on the bottom side of the insulation.

D. Within exterior wall framing, install insulation between pipes and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.

E. Where showers and bathtubs are located on exterior walls, typically install insulation and vapor

retarder between units and exterior.

F. If eave ventilation baffles are required, install ventilation baffles at eaves to hold insulation down from roof sheathing and provide positive ventilation from eave to attic space.

G. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation in the cavity during installation, creating gaps or voids that could diminish thermal value.

H. Trim insulation neatly to fit spaces. Fill miscellaneous gaps and voids with insulation.

I. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

J. For unfaced batt insulation, install with friction fit or retain in place with manufacturer's recommended fasteners or mesh.

K. For batt insulation with factory-applied facing, install with vapor retarder membrane facing warm in the winter side of building spaces or as specified by local building code. Lap ends and side flanges of membrane over or between framing members. Tape to seal tears, cuts or misalignments in membrane.

L. Secure insulation in place using one of the following methods: Friction fit; staple or nail facing flanges in place as needed, tape in place, retain in place with spindle fasteners, retain in place with wire mesh secured to framing members.

3.07 ROOF INSULATION BOARD INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board are not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch with like material.

E. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Refer to Division 07 Roofing specifications for additional installation requirements.

3.07 CLEAN-UP

A. Do not permit insulation debris to accumulate in building or on job site.

B. Upon completion of work, leave premises clean, free from scraps and debris.

3.08 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. If black tape or coatings are installed over the XPS insulation board, cover the black surfaces as soon as possible to avoid damage due to potential solar heat build-up on the black surface.

C. Do not permit extruded polystyrene insulation board to come in contact with surfaces or temperatures in excess of 165°F.

D. Touch-up, repair, or replace damaged products.

3.09 VERIFICATION

A. Upon completion of the installation in each area, visually inspect and verify that all insulation is complete and properly installed.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072113 – ULTRA WALL INSULATION AND AIR BARRIER SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of Ultra Wall System and air barrier system for installation in all cavity wall construction, as indicated on the drawings and specified herein. This Section includes the following:

1. Materials and installation methods for cavity wall insulation and air barrier system located in the non-accessible part of the wall.

2. Materials and installation to bridge and seal the following air leakage pathways and gaps:

   a. Connections of the walls to the roof air barrier.
   b. Connections of the walls to the foundations.
   c. Seismic and expansion joints.
   d. Openings and penetrations of window frames, store front, curtain wall.
   e. Barrier precast concrete and other envelope systems.
   f. Door frames.
   g. Piping, conduit, duct and similar penetrations
   h. Masonry ties, screws, bolts and similar penetrations.
   i. All other air leakage pathways in the building envelope.

3. Materials to act as flashings and counter-flashings.

B. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

C. Related Sections include the following:

1. Section 033000 – Cast-In-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 054000 – Cold Formed Metal Framing
4. Section 061000 – Rough Carpentry
5. Section 061643 – Gypsum Sheathing
6. Section 072100 – Building Insulation
7. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
8. Section 076000 – Flashing and Sheet Metal
9. Section 079200 – Joint Sealants
10. Various Division 07 Roofing Specifications - requirement for coordination sequencing of membrane roofing; requirement to seal roof membrane to wall air barrier.
11. Section 085113 – Aluminum Windows – for window units at the periphery of the building.
12. Section 084113 – Aluminum Entrances and Storefronts
13. Section 084413 – Glazed Aluminum Curtainwalls

D. Products Installed, but not Supplied under This Section:

1. Self-Adhering Flexible flashings to be built into exterior wall systems are furnished under Section 072713.

1.02 REFERENCE STANDARDS

A. ASTM C272 – Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions; 2018.
B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2016.
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
D. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
F. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.
G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.03 QUALITY ASSURANCE

A. Standards: Comply with standards specified in this section and as listed in Section 014219.

B. Performance Requirements: Provide air/vapor barrier system constructed to perform as a continuous air/vapor barrier system, as building thermal insulation, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. System shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

1. Provide a tested system in accordance with the Air Barrier Association of America's (ABAA's) testing protocol, provide air barrier materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft^2 @ 1.57 psf), when tested in accordance with ASTM E2178 (unmodified).

2. The water vapor permeance shall be determined in accordance with ASTM E 96 and shall be declared by the material manufacturer.

3. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:

   a. Foundation and walls, including penetrations, ties and anchors.
   b. Walls, windows, curtain walls, storefronts, louvers and doors.
   c. Different assemblies, and fixed openings within those assemblies.
   d. Wall and roof connections.
   e. Floors over unconditioned space.
   f. Walls, floor and roof across construction, control and expansion joints.
   g. Walls, floors and roof to utility, pipe and duct penetrations.
   h. Seismic and expansion joints.
   i. All other potential air leakage pathways in the building envelope.

C. Installer Qualifications:

1. Submit evidence of current Contractor accreditation and Installer certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of the Contractor and certification number(s) of the ABAA Certified Installer(s).

2. Each worker who is installing air barriers must be either a Certified Applicator or an installer who is registered with ABAA.

3. Each lead Certified Applicator can supervise a maximum of five registered installers. The Certified Applicator shall be thoroughly trained and experienced in the installation of air barriers

of the types being applied. Lead Certified Applicators shall perform or directly supervise all air/vapor barrier work on the project.

4. Air Barrier Installers shall be certified by BPQI (Building Performance Quality Institute) for the ABAA Quality Assurance Program in accordance with the requirements outlined in the QAP program used by ABAA. Installers shall have their photo-identification air barrier certification cards in their possession and available on the project site, for inspection upon request.

D. Single-Source Responsibility: Obtain primary ABAA listed materials from a single ABAA Evaluated Manufacturer regularly engaged in manufacturing specified rigid cellular thermal insulation board. Obtain secondary materials from a source acceptable to the primary materials Manufacturer.

E. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

F. Thermal Insulation: Not produced with, or contain, any of U.S. EPA regulated chlorofluorocarbon (CFC) compounds listed in Montreal Protocol of United Nations Environmental Program.

G. Surface Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

H. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

I. Field-Constructed Mock-Ups: Prior to installation of air/vapor barrier, apply air/vapor barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution:

1. Apply air/vapor barrier in field-constructed mock-ups of assemblies specified in Section, “Unit Masonry”.

2. Construct typical exterior wall panel, 8 feet long by 8 feet wide, incorporating back-up wall, partial cladding, window and doorframe and sill, insulation, flashing, building corner condition, junction with roof system, foundation wall and typical penetrations and gaps; illustrating materials interface and seals. All transition membranes and seals shall be installed per the manufacturer’s system requirements.

3. Test mock-up for air and water infiltration in accordance with ASTM E 783 and ASTM E1105.

J. Implement the site Quality Assurance Program requirements used by ABAA. Cooperate with ABAA Auditor and independent testing and inspection agencies engaged by the Owner. Do not cover the air barrier assembly until it has been inspected, tested and accepted.

1.04 SUBMISSIONS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

1. At bid submission, provide evidence to the Architect of current Contractor accreditation and Installer certification under the Air Barrier Association of America’s (ABAA) Quality Assurance Program. Submit accreditation number of the Contractor and certification number(s) of the ABAA Certified Installer(s).

2. Submit shop drawings showing locations and extent of air barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the materials are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

3. Product Data: Submit manufacturer's product data sheets for each type of material, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

    a. Submit manufacturer's specifications and installation instructions and recommended procedures for application.
    b. Submit letter from primary materials Manufacturer indicating approval of products not manufactured by primary manufacturer.
    c. Include statement that materials are compatible with adjacent materials proposed for use.
    d. Submit letter from Manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from Manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

4. Air Barrier Assembly Testing: Verify air barrier assembly testing by the material manufacturer by visiting the ABAA website to ensure an ASTM E2357 test has been completed and to obtain results. Visit the ABAA website for the reported air barrier assembly leakage rate and illustrations or CAD details which includes the methods in which the assembly test mock-ups shall be assembled.

5. Certification by air/vapor barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

6. Certification of compatibility by air/vapor barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it.

7. Submit three samples, 3 by 4 inch minimum size, of each air/vapor barrier material required for Project.

B. LEED Submittals: (Required for LEED Projects only)

1. Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 – LEED Requirements.

2. Credit EQ 4.1: Manufacturers' product data for interior field-applied adhesive and sealant products included in this section, including printed statement of VOC content in accordance with Section 013563 – LEED Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, expiration date, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air/vapor barrier manufacturer. Protect stored materials from direct sunlight.

C. Protection: Use all means necessary to protect the materials of this section before, during, and

after installation and to protect the work and materials of other trades. Protect thermal insulation materials from physical damage and from deterioration due to moisture, soiling and other sources; store in dry interior location.

1. Do not expose to direct sunlight. Exposure limit 90 days.
2. Protect against ignition at all times.
3. Quickly complete installation and concealment of foam plastic board installation in each area of construction.

D. Comply with manufacturer's written recommendations for handling, storage, and protection during installation.

E. Avoid spillage. Immediately notify Owner if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

1.06 WASTE MANAGEMENT AND DISPOSAL

A. Separate and recycle waste materials in accordance with Section 017419 – Construction Waste Management. (For LEED Projects only)

B. Place materials defined as hazardous or toxic waste in designated containers.

C. Ensure emptied containers are sealed and stored safely for disposal away from children.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Apply air/vapor barrier within range of ambient and substrate temperatures recommended by air/vapor barrier manufacturer. Do not apply air/vapor barrier to a damp or wet substrate, unless the manufacturer specifically permits that for the product.

B. Do not apply air/vapor barrier in snow, rain, fog, or mist.

C. Do not apply air/vapor barrier components when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

D. Compatibility. Do not allow rigid cellular thermal insulation board to come in contact with chemically incompatible materials.

E. Ultra-violet exposure. Do not expose rigid cellular thermal insulation board air barrier to sunlight longer than as recommended by the Manufacturer of the material.

F. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

1.08 WARRANTY

A. For sealant and membrane materials, the 12-month warranty period shall be extended to 24 months.

B. Material Warranty: Provide the manufacturer’s three (3) year air/vapor barrier material warranty under the provisions of the General and Supplementary Conditions, and Section 017000, Contract Closeout.

C. System Warranty: Provide the manufacturer’s three year system warranty, including the primary air/vapor barrier and installed accessory sealant and membrane materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Air Barrier: Tested in accordance with ASTM E2357 at pressure of 6.24 psf (300 Pa) or greater, with air infiltration less than 0.04 cfm/sq ft (0.2 L/sq m) of fixed wall area.

1. Conduct testing at positive and negative sustained wind loading of 12.5 psf (0.6 kPa) for one-hour duration in each direction.

2. Provide pressure cycling of wall at 2000 cycles in both positive and negative directions, ending with wind gust loading at 25 psf (1.2 kPa).

B. Water Penetration: Tested in accordance with ASTM E331, with minimum pressure differential of 6.24 psf (300 Pa) for at least two hour test duration without any uncontrolled water penetration.

1. All joints, penetrations, and gaps of the thermal (and air) layer wall system shall be made water and air tight.

2.02 DUPONT™ CAVITYMATE™ ULTRA WALL INSULATION SYSTEM

A. General: Design is based on insulating materials as specified on drawings. The terminology used may include reference to specific manufacturers' proprietary products. Such reference shall be construed only as establishing the quality of the materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

B. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

C. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578, Type IV with patented carbon-black technology wall insulation system placed between wall anchors of masonry veneer cavity walls and with seam treatment to form a continuous thermal, air, and water barrier system.

1. Basis of Design:

a. DuPont de Nemours Inc.; DuPont™ Styrofoam™ Brand Cavitymate™ Extruded Polystyrene Insulation: building.dupont.com/commercial; with carbon black materials in the foam and square edges. Boards installed horizontally, typically 15-3/4 inch by 96-inch orientation.

2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

4. Compressive Resistance: At least 25 psi (173 kPa).

5. Density: At least 1.45 lbs/cu ft (23 kg/cu m).

6. Water Vapor Permeance: Maximum of 1.5 perms (86 ng/Pa sec sq m) per 1 inch (25.4 mm) thickness.

7. Board Overall Dimensions: 15-3/4 inch (400 mm) wide by 96 inch (2.44 m) long.

8. Board Thickness: Nominal thickness of 2.125" or as shown on drawings, with square edge treatment along edges.

9. Thermal Resistance (R-value): R-5.6/in at 75 degrees F.

10. Water Absorption: ASTM C272, 0.1% max, by volume.

2.03 ACCESSORIES

A. Gypsum Sheathing: Provide moisture and mold-resistant glass mat gypsum wall board in accordance with Section 061643.

B. Board Insulation Bonding Adhesive: Provide product as recommended by insulation manufacturer that will not damage insulation or substrates.

1. Products: Great Stuff Pro™ Gaps and Cracks single component polyurethane low-pressure sealant single component polyurethane low-pressure foam sealant as manufactured by DuPont de Nemours Inc.

C. Foam Sealant Penetration Filler: Provide single component spray polyurethane foam (SPF) for sealing wall penetrations through board insulation.

1. Products: DuPont™ Great Stuff Pro™ Gaps and Cracks* single component polyurethane low-pressure sealant or DuPont™ Great Stuff Pro™ Window and Door* single component polyurethane low-pressure foam sealant as manufactured by DuPont de Nemours Inc.

D. Face Repair Flashing: Provide board insulation manufacturer's recommended flashing for repair of damaged board insulation facer.

1. Products:

a. DuPont™ LiquidArmor™ CM* Spray Flashing and Sealant as manufactured by DuPont de Nemours Inc.
b. DuPont™ LiquidArmor™ LT* Flexible Single Component Silicone Flashing as manufactured by DuPont de Nemours Inc.
c. DuPont™ LiquidArmor™ QS Spray Flashing and Sealant* as manufactured by DuPont de Nemours Inc.

E. Flashing and Sealant: Provide for sealing joints, seams and veneer tie penetrations through board insulation.

1. One component polyurethane foam.

a. Product: DuPont™ Great Stuff Pro™ Gaps & Cracks polyurethane foam sealant* as manufactured by DuPont de Nemours Inc. for gaps >= 1/4" wide.

2. Spray applied elastomeric liquid flashing and sealant, grey-blue color.

a. Product: DuPont™ LiquidArmor™ CM Flashing and Sealant* (for gaps < 1/4”) as manufactured by DuPont de Nemours Inc.
b. Product: DuPont™ LiquidArmor™ QS Spray Flashing and Sealant* (for gaps < 1/4”) as manufactured by DuPont de Nemours Inc.

3. Trowel applied single component silicone flashing and sealant, grey color.

a. Product: DuPont™ LiquidArmor™ LT Flashing and Sealant* (for gaps <1/4”) as manufactured by DuPont de Nemours Inc.

F. Roof/Wall Juncture Sealing

1. Maintain continuity of air barrier by sealing the roof/wall juncture.

2. Acceptable Products:

    a. DuPont de Nemours Inc.; FROTH-PAK Foam Insulation (Class A).

G. Self-Adhering Transition Flashing: Provide for through-wall flashing, roof-to-wall transitions, parapet transitions, above window kick-outs, wall to below-grade transitions, wall offsets, rough window openings, balcony transitions.

1. Product: DuPont™ DuraGard™ CM Transition Flashing as manufactured by DuPont de Nemours Inc.

2.04 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of the work of this section, shall be as selected by the Contractor, subject to the approval of the Architect.

B. Provide sealants in accordance with Section 079200 - Joint Sealants. Comply with ASTM C920 and ASTM C920 classifications for type, grade, class, and uses.

1. Silicone Sealant (Type A): Natural cure, low modulus, to seal sheet membrane flashing to polyethylene face of sheet rubberized-asphalt barrier and to seal between and to non-bituminous sheet systems.

    a. Acceptable materials: DOWSIL 790™; Pecora 864 NST

2. Substrate Cleaner: Non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Carefully examine all the areas and conditions under which work of this section will be installed, with installer present, for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing work of this section; correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Insure that work of all preceding trades is completed prior to starting work of this Section.

C. Do not proceed with installation until after minimum concrete curing period recommended by air/vapor barrier manufacturer.

D. Ensure that:

1. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants;

2. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions;

3. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.

E. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

F. Notify the Architect in writing of anticipated problems using air/vapor barrier over substrate.

3.02 INSTALLATION, CAVITYMATE™ ULTRA WALL INSULATION SYSTEM

A. Installation Instructions for Air Barrier – Rigid Cellular Thermal Insulation Board: Install insulation boards air barrier in a way that provides continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and installation instructions along with the following:

1. Apply 2 inch diameter daubs of adhesive at four corners of interior face of board insulation and one at the center, for total of five.

2. Place board insulation between wall ties and other obstructions with staggered joints and provide 1/4 inch to 1/2 inch wide gap at end joints.

    a. Press board insulation units firmly against wall sheathing of cavity wall construction, and ensure insulation is continuous.
    b. Make insulation continuous.

3. Fill open spaces between board insulation with single component foam sealant to ensure continuous air and water vapor barrier.

4. Install board insulation to cover entire insulated area, cut and fit insulation tightly around obstructions, and properly remove projections that interfere with insulation placement.

5. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

6. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

7. Install the insulation boards air barrier with the printed side out.

8. If the insulation boards have shiplap edges, install with the top shiplap edge up and against the substrate face.

9. Install boards with the eight or twelve foot length horizontally. Use maximum board lengths to minimize number of joints.

10. Abut insulation boards tightly around openings and penetrations.

11. Seal all edge and end joints and through wall penetrations such as doors and windows with self-adhering flashing, approved sealant foam or sealant tape.

12. Install self-adhered flashing or sealant tape in a shingle fashion over all joints. Overlap the joints in the tape by the width of the tape (i.e. 4 inch tape is overlapped 4 inch.

13. Repair all damage to insulation boards air barrier. Install a section of new insulation boards the same size as cut out. Seal any gaps with sealant foam. Install self-adhered flashing or sealant tape in a shingle fashion over all joints. For small holes, fill the small hole first with sealant foam then cover with self adhered flashing, or sealant tape in a shingle fashion over all joints.

3.03 INSTALLATION, GENERAL

A. Roof/Wall Juncture:

1. Maintain continuity of air barrier by sealing the roof/wall juncture with Roof/Wall Juncture Sealing material.

B. Flashing and Sealant:

1. Apply material within application limits of product manufacturer.

2. Do not apply product on surfaces with standing water or frost.

3. Avoid installing on days with a high probability of significant rainfall.

4. Seal gaps greater than 1/4 inch in width with penetration filler prior to applying flashing and sealant.

    a. If facer on board insulation is damaged, make note of affected area and apply additional spray over damaged area.
    b. Replace damaged insulation, or repair facer flaws with appropriate flashing as recommended by insulation panel manufacturer.

5. Apply flashing and sealant to board joints, penetrations and other fenestration openings as required at material required application thickness.

    a. Apply flashing 3 inches, plus or minus 1 inch wide over board insulation joints, with at least 1 inch of spray covers each side of joint.
    b. Apply flashing over fasteners and washers along board insulation joints.
    c. Install façade attachment system after flashing has been applied.

6. Rough Openings: Apply flashing and sealant at least 3 inches onto face of insulation panel sheathing, and completely cover edge of insulation board; also spray at least 3 inch back onto rough opening substrate.

    a. It is recommended to cover back onto rough opening at least 1 inch past the interior weatherseal.

7. Board Insulation or Substrate Penetrations: Apply flashing and sealant at least 2 inches onto face of insulation sheathing and at least 2 inches onto penetration or primary flashing substrate.

8. Use wet mil thickness gauge to ensure proper installation thickness.

    a. Where consistently below minimum thickness, apply another layer to achieve proper thickness requirements.

9. Visually inspect for any areas missed and trowel on sealant as necessary.

3.04 FIELD QUALITY CONTROL

A. Site Tests:

1. The Licensed Installer shall complete the Daily Work Record and record all information required including the results of the testing. The Daily Work Record shall be kept on site for routine inspection. Copies of the Daily Work Record shall be forwarded to the Owner or Owner's representative upon request. Copies of the Daily Work Record or monthly summaries shall

be sent to the Owner's Representative on a monthly basis as required by the Quality Assurance Program.

2. Transition membranes shall be pull tested in accordance with the in-place Quality Assurance Program requirements.

3. The costs incurred for daily testing and inspection by the Licensed Installer and the completion of the Daily Work Record shall be borne by the Licensed Contractor.

3.05 INSPECTION

A. Arrange for site inspections by the Owner's Representative. The cost of inspections shall be included in the bid provided by the Prime Contractor.

B. The site-inspections shall verify conformance with the manufacturers instructions, the standard ULC S705.2-02 Installation standard, the Quality Assurance Program, and this section of the project specification.

C. Inspections and testing shall be carried out at 5%, 50% and 95% of completion. A written inspection report shall be forwarded to the architect and the licensed installer within 3 working days of the inspection and test being performed. In the case of any deficiencies, the licensed inspector may verbally advise the licensed installer at the time of the inspection.

D. If the inspection reveals any defects, the Licensed Contractor shall immediately rectify all such defects at his cost.

3.06 PROTECTION & CLEAN-UP

A. Do not permit insulation debris to accumulate in building or on job site.

B. Upon completion of work, leave premises clean, free from scraps and debris.

C. Protect air barrier materials from damage during installation and the remainder of the construction period, according to manufacturer's written instructions.

D. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the air barrier manufacturer.

E. Protect board insulation from excess moisture, mechanical damage, and exposure to open flame.

F. Repair damage caused to board insulation in a manner that retains integrity and continuity of insulation and facer materials.

G. Keep board insulation dry and above water on jobsite, and cover with tarp until ready for installation.

H. Promptly cover board insulation with cladding.

3.07 VERIFICATION

A. Upon completion of the installation in each area, visually inspect and verify that all insulation is complete and properly installed.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072114 – MINERAL BOARD INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of fireproofing insulation and smoke-stop materials at voids around penetrations through fire-rated and smoke barrier wall and roof construction assemblies, and as indicated on the drawings and specified herein

B. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

C. Related Sections include the following:

1. Section 042000 – Unit Masonry
2. Section 051200 – Structural Steel Framing
3. Section 052100 – Steel Joist Framing
4. Section 053000 – Metal Decking
5. Section 072100 – Building Insulation

1.02 QUALITY ASSURANCE

A. Standards: Comply with standards specified in this section and as listed in Section 014219.

B. Reference Standards:

1. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
2. ASTM C518 - Steady-State Thermal Transmission Properties by Means of The Heat Flow Meter.
3. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E119: Standard Test Methods for Fire Tests of Building Constructions and Materials.

1.03 SUBMISSIONS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

B. Product Data: Submit manufacturer's specifications and installation instructions for each type of insulation.

C. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, densities, compression strengths, fire performance, perm ratings, water absorption ratings, and similar properties.

D. Samples for Verification:

1. Submit, to the job site, 6” x 6” samples of each type and thickness of fireproofing insulation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in their original, unopened packages or containers with all labels intact

and legible. Protect all materials from physical damage and from deterioration by moisture, soiling, and other sources.

B. Store all materials in a single location protected from weather, moisture, and open flame or sparks.

C. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of other trades.

D. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 FIREPROOFING INSULATION MATERIALS

A. Basis-of-Design: Thermafiber® SAFB™ (Sound Attenuation Fire Blanket) by Thermafiber, Inc. (an Owens Corning company), One Owens Corning Parkway, Toledo, OH 43659. Toll free 888-834-2371, Fax 260-563-8979, or www.owenscorning.com.

B. Materials:

1. Mineral Wool Batts: Formaldehyde-free option, non-combustible, moisture-resistant, non-corrosive, non-deteriorating, mildew-resistant, and vermin-resistant mineral.

2. Standards and Codes Compliance:

   a. NFPA 101: Class A rated interior finish.
   b. ASTM C 665: Type I, non-corrosive.
   c. ASTM E 136: Non-combustible.
   d. CAN/ULC S114: Complies.
   e. ASTM C 1104: Absorbs less than 1% by volume.
   f. ASTM E 84/CAN/ULC S102: Flame Spread 0, Smoke Developed 0.

3. Properties:

   a. Density: 4.0 pcf for 1-inch thickness, 2.5 pcf for thicknesses 1-1/2 inches to 7 inches.
   b. Manufacturing Tolerance: Plus 1/4 inch, minus 1/8 inch for thickness, plus or minus 1/8 inch for widths, plus or minus 1/2 inch for lengths.

4. Fiber Type: Standard fiber 70% pre-consumer recycled content.

5. Fiber Type: EPA Choice fiber; minimum 75% pre-consumer recycled content; complies with EPA Preference Program.

2.02 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of the work of this section, shall be as selected by the Contractor, subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 INSPECTION

A. Carefully examine all the areas and conditions under which work of this section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Except as otherwise specifically directed by the Architect, install all building insulation in the size and thickness specified, in strict accordance with the manufacturer's instructions.

B. Install insulation in accordance with approved submittals, manufacturer's written recommendations, and guidelines.

1. Interior Stud Cavity: Friction-fit SAFB securely between studs. Butt ends of blankets closely together and fill all voids.

2. Creased SAFB: Using SAFB 1 inch wider than regular blankets, bow the blankets slightly to fit into stud cavity. Slit the blankets vertically 1inch deep with a utility knife down the center.

3. Floor-Ceiling: Friction-fit SAFB securely between floor joints.

4. Ceiling Overlayment: Lay SAFB over ceiling panels extending 48 inches beyond all partitions. Tightly fit around all hangers, obstructions, and penetrations.

C. Do not over-compress insulation to fit into spaces.

D. Fit insulation closely around electrical boxes, pipes, ducts, frames, and other objects in or passing through insulation.

E. Install products in proper relationship with each other and adjacent construction.

F. Repair damage to adjacent materials caused by insulation installation.

3.03 CLEAN-UP

A. Do not permit insulation debris to accumulate in building or on job site.

B. Upon completion of work, leave premises clean, free from scraps and debris.

3.04 PROTECTION

A. Protect installed products from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. Protect installed products and accessories from damage during construction.

3.05 VERIFICATION

A. Upon completion of the installation in each area, visually inspect and verify that all insulation is complete and properly installed.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072419 – EXTERIOR INSULATION AND FINISH SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This document is to be used in preparing specifications for an Exterior Insulation and Finish System (EIFS) with Moisture Drainage including:

1. An integral fluid applied air and water-resistive membrane barrier compatible with the substrate surface and adhesive application of the EIF system.

2. Accessory materials required for treating sheathing joints, fasteners, penetrations, rough openings, and material transitions compatible with substrate surfaces and the adhesive application of the EIF system.

3. Ultra high impact mesh assembly over entire EIFS cladding wall area.

4. Joint sealants compatible with specified EIFS for use in all exterior envelope joint waterproofing.

5. A comprehensive single source limited EIF system warranty inclusive of EIFS, fluid applied air and water-resistive membrane barrier, accessory materials, and sealants.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Related Sections:

1. Section 033000 – Cast-in-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 054000 – Cold Formed Metal Framing
4. Section 061000 – Rough Carpentry
5. Section 061643 – Exterior Gypsum Sheathing
6. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
7. Section 076000 – Flashing and Sheet Metal
8. Section 079200 – Joint Sealants

1.03 REFERENCE STANDARDS

A. ASTM Standards:

1. ASTM C 150 - Specification for Portland Cement
2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
3. ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
4. ASTM C 1382 - Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints
5. ASTM C 1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish System (EIFS) and EIFS with Drainage
6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

7. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials
8. ASTM E 119 - Standard Method for Fire Tests of Building Construction and Materials
9. ASTM E 2098 - Test Method for Determining the Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to Sodium Hydroxide Solution
10. ASTM E 2134 - Test Method for Evaluating the Tensile-Adhesion Performance of Exterior Insulation and Finish Systems (EIFS)
11. ASTM E 2178 - Standard Test Method for Air Permeance of Building Materials
12. ASTM E 2273 - Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
13. ASTM E 2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
14. ASTM E 2430 - Standard Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish Systems (EIFS)
15. ASTM E 2485 - Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings
16. ASTM E 2486 - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
17. ASTM E 2568 - Standard Specification for PB Exterior Insulation and Finish Systems
18. ASTM E 2570 - Standard Test Method for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage

B. National Fire Protection Association (NFPA) Standards:

1. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source
2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components

C. The American Association of Textile Chemists and Colorists:

1. AATCC 127-08 - Water Resistance: Hydrostatic Pressure Test

D. US Federal Specifications:

1. TT-S-001543A - Sealing Compound: Silicone Rubber Base (for Calking, Sealing, and Glazing in Buildings and Other Structures

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meeting:

1. The EIFS installer shall coordinate with the General Contractor to schedule, invite and administer a pre-construction meeting including but not limited to the architect of record, consultant(s), EIFS, sheathing board, accessory materials and sealant manufacturer's representatives and the owner to assure required integration of products selected as specified herein and for proper sequencing and installation detailing.

B. Coordinate for related specification and integration of Selected Materials as referenced in Section 2.02.B.1, 2.02.B.2 and 2.02.C herein below.

C. Sequencing:

1. Provide jobsite grading prior to installation of Exterior Insulation and Finish System with Moisture Drainage so that the system may be terminated at 8 in above grade or as required by code.

2. Coordinate installation of sheathing board and accessory materials, flashing, foundation waterproofing, roofing membrane, windows, doors, and other penetrations of the exterior walls to provide a continuous air and water-resistive membrane barrier.

3. Provide protection of rough openings before installing windows, doors, and other penetrations of the exterior walls.

4. Coordinate installation of windows and doors so air and water-resistive membrane barrier accessory materials, transitions, flashings, etc. are connected to them to provide a continuous barrier.

5. Install window and door head flashings immediately after windows and doors are installed.

6. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.

7. Install copings and sealants immediately after installation of the Exterior Insulation and Finish System with Moisture Drainage and when EIFS coatings are dry.

8. Attach penetrations through Exterior Insulation and Finish System to structural support and provide water-tight seals at penetrations.

1.05 SUBMITTALS

A. Submit product data as required by Section 013300 – Submittal Procedures.

B. Submit shop drawings for panelized EIFS with Moisture Drainage showing wall layout, connections, details, expansion joints, and installation sequence.

C. Submit two (2) samples of the Exterior Insulation and Finish System with Moisture Drainage for each finish, texture, and color to be used on the project. Use the same tools and techniques proposed for the actual installation. Make the samples of sufficient size to accurately represent each color and texture being utilized on the project.

D. Submit a current copy of the manufacturer's Trained Contractor Certificate for the EIF system specified. Submit Owner/Architect-requested test results verifying the performance of the Exterior Insulation and Finish System with Moisture Drainage.

E. Submit a copy of the manufacturer's installation details and application instructions.

F. Submit a copy of the manufacturer's recommended maintenance and repair manual.

1.06 QUALITY ASSURANCE

A. Manufacture's Qualifications:

1. A member in good standing of the EIFS Industry Members Association (EIMA).

2. Manufacture Exterior Insulation and Finish System with Moisture Drainage materials at a facility covered by a current ISO 9001:2015 and ISO 14001:2015 certification. Certification of the facility is done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).

B. Contractor's Qualifications:

1. Knowledgeable in the proper installation of the Exterior Insulation and Finish System with

Moisture Drainage.

2. Possess a current copy of the manufacturer's Trained Contractor Certificate for the EIF system specified.

3. Successfully complete a minimum of five (5) projects of similar scope and scale to the specified project.

C. Insulation Board Manufacturer Qualifications:

1. Listed by EIFS Manufacturer, and capable of producing the Expanded Polystyrene (EPS) in accordance with the current EIFS Manufacturer's Specification for Insulation Board.

2. Subscribe to the Dryvit Third Party Certification and Quality Assurance Program.

D. Panel Fabricator Qualifications:

1. Experienced and competent in the fabrication of architectural wall panels.

2. Possess a current Outsulation HDCI System Trained Contractor Certificate* issued by Dryvit Systems, Inc.

E. Panel Erector Qualifications:

1. Experienced and competent in the installation of architectural wall panel EIF systems.

2. Shall be:

a. The panel fabricator or
b. An erector approved by the panel fabricator or
c. An erector under the direct supervision of the panel fabricator.

F. Mock-Up:

1. Prior to installation of the wall systems, erect sample wall mock-up using materials and joint details required for final work. Provide special features as directed for sealant and contiguous work. Build mock-up at the site where directed, of full thickness, indicating the proposed color, texture, and workmanship to be expected in the completed work. Obtain Architect's acceptance of the mock-up in regard to the aesthetic quality, before start of work. Retain mock-up during construction as a standard for judging completed work. Do not alter, move, or destroy mock-up until work is completed, and until final acceptance of the project by Architect.

G. Regulatory Requirements:

1. Separate the EPS insulation board from the interior of the building by a minimum 15-minute thermal barrier.

2. Comply with local building codes for the use and maximum thickness of EPS insulation board.

H. Inspections:

1. Cooperate with independent, third-party inspectors when required by code or by contract documents.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver all Exterior Insulation and Finish System with Moisture Drainage components and materials to the job site in the original, unopened packages with labels intact.

B. Inspect all Exterior Insulation and Finish System with Moisture Drainage components and materials upon arrival for physical damage, freezing or overheating. Do not use questionable materials.

C. Store all Exterior Insulation and Finish System with Moisture Drainage components and materials at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Maintain minimum and maximum storage temperature as stated in the product data sheets or specifications for the materials selected.

D. Protect all products from inclement weather and direct sunlight.

1.08 SITE CONDITIONS

A. Ambient Conditions:

1. Do not apply wet materials during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.

2. Verify the minimum air and wall surface temperatures at the time of application as stated in the product data sheets or specifications for the materials selected.

3. Maintain these temperatures with adequate air ventilation and circulation for a minimum of 24 hours (48 hours for specific Specialty Finishes) thereafter, or until the products are completely dry.

B. Existing conditions: The Applicator shall have access to electric power, clean water, and a clean work area at the location where the EIFS materials are being stored.

C. Environmental conditions: The ambient air and wall temperature on both sides of the wall shall be a minimum 40°F of 45°F as applicable at the time of installation of the EIFS materials. Refer to the manufacturers product sheets for specific product temperature requirements. The temperature shall remain so for at least 24 hours thereafter or longer if necessary for the material to be sufficiently dried.

D. Protection:

1. Adjacent areas/materials shall be protected from damage, drops, and spills during the application of the EIFS system.

2. The EIFS materials shall be protected by permanent or temporary means from weather and other damage prior to, during and immediately after application. Care must be taken to prevent condensation and/or heat build-up when using tarp or plastic prevent damage to the EIFS system or products.

E. Sequencing and Scheduling:

1. Installation of the EIFS system shall be coordinated with the other construction trades.

2. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.09 WARRANTY

A. Manufacturers' Limited EIF System Warranty:

1. Manufacturer shall offer a limited material defect and labor to repair or replace defective material warranty stating the Products will be free from manufacturing defect and will perform as warranted in the manner specified for the stated term measured from the Date of Project Substantial Completion.

    a. A pre-construction meeting, including representatives of the Manufacturer, the Applicator, the Owner, and the Consultant (if applicable), shall be required prior to installation of the Products.
    b. When the EIF System materials which are manufactured and sold by Dryvit are installed in accordance with Dryvit's current published literature under normal weather conditions and excluding unusual air pollution, will have a base coat, mesh and finish (the "Lamina") that is resistant to puncture.
    c. The warranty is available upon written request.

2. The EIF system warranty shall additionally include the following for the term of the warranty or as specifically noted hereunder.

    a. The EIF system warranty term shall be 10 years.
    b. The EIFS will remain in a watertight condition when the EIFS is used in conjunction with approved Company Joinery and Sealants.
    c. The EIFS will drain incidental moisture between the air/water-resistive barrier and the insulation board.

        1) Remedy includes repair or replacement of any sheathing or framing member that is damaged as a result of the EIF system failing to drain incidental moisture between the secondary weather barrier and the insulation board.

    d. Finish will be UV fade resistant for 10 years, except for specially produced colors.

        1) Specially produced colors will be UV fade resistant for 5 years when high-performance colorants are used to formulate.

B. Installer Warranty:

1. EIF system Installer shall provide a separate minimum 1-year warranty for all workmanship related to the proper installation and drainage performance of the EIFS application. Manufacturer shall not be responsible for workmanship associated with the installation of Exterior Insulation and Finish System with Moisture Drainage.

1.10 DESIGN AND DETAILING:

A. General:

1. The EIFS system is and externally reinforced exterior insulation and finish system consisting of an adhesive, insulation board, fiberglass reinforced mesh fully embedded in a basecoat mixture and an aesthetic finish.

2. The EIFS System is applied to the substrate system in place.

    a. At all termination locations, the MEPS shall be completely encapsulated by the base coat.
    b. The length and slope of inclined surfaces shall follow the guidelines listed as follows: (1) Minimum slope: 6" of rise in 12" of horizontal projection. (2) Maximum length of slope: 10".

(3) Incline surfaces shall not be used for areas defined as roofs.

3. Corners shall be reinforced by wrapping with reinforcing mesh or installing corner mesh.

4. Openings shall be reinforced using a 9 ½" wide strip of detail reinforcing mesh laid at a 45° angle.

5. Dimensional Tolerances: All substrates shall be flat within ¼" within a 4' radius.

6. Substrate System:

   a. Maximum deflection under full flexural design loads of the substrate shall not exceed L/240 under wind load.
   b. It is the Applicators responsibility to ensure the substrate is acceptable for application of the EIFS system.
   c. Approved substrate shall include but not be limited to the following:

      1) Plywood having a minimum thickness of ½" and shall be a minimum of 4 ply, Exterior grade C-D or better complying with the latest edition of U.S. Product Standard PSI and APA performance standards.
      2) Exterior grade gypsum sheathing having a minimum thickness of ½" and shall conform to Federal specifications SS-L-30D, Type II, Grade W, Class 2 ASTM C-79.

7. Expansion joints in the EIFS system are required at building expansion joints, if prefabricated, at panel joints, where substrates change and where significant structural movement occurs, control joints shall be where indicated on plans or where required.

B. Approvals, Listings, and Classifications:

1. The Coating and approved insulation board shall be classified by a nationally recognized testing agency and shall meet the smoke developed and flame spread ratings as set forth by ASTM E84.

PART 2 - PRODUCTS

2.01 GENERAL

A. For the purposes of this specification the EIFS Systems has been based upon products as manufactured by Dryvit Systems, Inc., One Energy Way, West Warwick, RI 02893, 800-556-7752, www.dryvit.com and Tremco, Inc., 3735 Green Road Beachwood, OH 44122 **800.321.7906**, www.tremco.com; or approved equal. Terminology references this manufacturer's products as it related to their system.

B. All components of the Outsulation® Plus MD System® including EPS Insulation Board shall be supplied or obtained from Dryvit Systems, Inc., Tremco, Inc. or their authorized distributors. Substitutions or additions of materials manufactured or supplied by others will void the EIF system warranty.

C. Alternate EIFS manufacturers must demonstrate equivalency for all elements of EIF system such as but not limited to:

1. Material components, compatibility and testing
2. Standard and specialty finishes;
3. Color and texture matching; and,
4. Warranty criteria as specified herein

2.02 MATERIALS

A. System Description:

1. The Dryvit Outsulation Plus MD System is an Exterior Insulation and Finish System (EIFS) with Moisture Drainage, consisting of:

   a. An Air and Water-Resistive Membrane Barrier
   b. Accessory Materials
   c. Adhesive – installed in vertical ribbons to facilitate egress of incidental moisture
   d. Expanded Polystyrene (EPS) insulation board
   e. Base Coat
   f. Reinforcing Mesh
   g. Finish Coat
   h. Joint Sealants as specified herein below

B. Materials:

1. Fluid-Applied Air and Water-Resistive Barrier:

   a. Non-Permeable – Vapor Retarder / Barrier:

      1) Dryvit Backstop® NT-VB (Vapor Barrier): A standard film non-permeable, Class I, low-temperature, flexible, polymer-based non-cementitious water-resistive and air barrier coating available in Texture and Smooth versions. Backstop NT-VB can be installed in ambient air and substrate surface temperatures of 40 °F (5 °C) and rising for a minimum 24 hours and exposed for up to 6 months during the construction process. Backstop NT-VB Texture is additionally used for treatment of sheathing board joints, inside / outside corners and spotting of fastener heads.

2. Accessory Materials for Fluid Applied Air and Water-Resistive Barrier (AWRB):

   a. Provide compatible accessory materials as required by project conditions for substrate, rough opening and penetration preparation, bridge expansion joints in substrate, material transitions and flashing integration to produce a complete air and water-resistant assembly.

      1) Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive. Used in combination with Backstop NT or Backstop NTX Texture for treating sheathing board joints and inside / outside corners and preparing rough openings and penetrations. Backstop NT or Backstop NTX Texture is used alone for spotting fastener heads.

      2) Dryvit AquaFlash®: Fluid-applied, water-based polymer transition membrane. Used in preparing rough openings and penetrations, bridging expansion joints in substrate, material transitions and flashing integration. AquaFlash can be installed in ambient air and substrate surface temperatures of 40 °F (5 °C) and rising for 24 hours.

         a) Dryvit AquaFlash Mesh and Corners: Polyester reinforcing mesh for use with AquaFlash.

      3) Dryvit Backstop Flash and Fill: A flexible, waterproof, low temperature gun applied material. Used in substrate preparation, treating sheathing board joints, inside/outside corners and fastener heads, preparing rough openings and penetrations, bridging expansion joints in substrate material transitions and flashing integration. Backstop Flash and Fill can be installed in ambient air and substrate surface temperatures of 32 °F (0 °C) and rising for 24 hours.

4) Tremco ExoAir 110AT: A 22-mil composite impermeable membrane that is comprised of 16 mils of butyl and 6 mills of HDPP facer. Used in limited applications as a membrane flashing that will not interfere with the adhesive application of EIFS.

3. Drainage Components:

   a. Drainage Track UV treated PVC “J” channel perforated with weep holes, complying with ASTM D 1784 and ASTM C 1063. (Note: The use of Dryvit Drainage Track is limited to the base of the EIF system at finished grade level. Use Dryvit Drainage Strip at all other horizontal terminations.

   b. Acceptable manufacturers of Drainage Track:

      1) Starter Trac STWP – without drip edge by Plastic Components, Inc.
      2) Starter Trac STDE – with drip edge by Plastic Components, Inc.
      3) Universal Starter Track by Wind-lock Corporation
      4) Sloped Starter Strip with Drip by Vinyl Corp.

   c. Dryvit Drainage Strip™ corrugated plastic strip.

   d. Dryvit AP Adhesive™ urethane-based adhesive used to attach Drainage Track and Dryvit Drainage Strip to the sheathing.

4. Adhesives:

   a. Liquid polymer-based adhesive field mixed with Portland cement.

      1) Dryvit Primus®

5. Insulation Board:

   a. Expanded Polystyrene; minimum thickness 1 in; meeting Dryvit Specification DS131 and ASTM E 2430.

6. Pre-Coated Insulation Starter Boards, Corners and Shapes:

   a. Machine Coated Starter Boards, Corners and Shapes: Shall be produced with materials approved by Dryvit Systems, Inc. and be supplied by a fabricator approved by Dryvit Systems, Inc.

   b. Non-Machine Coated Starter Boards, Corners and Shapes: Shall be produced with materials approved by Dryvit Systems, Inc.

7. Base Coat:

   a. Liquid polymer-based base coat field mixed with Portland cement.

      1) Dryvit Primus

8. Reinforcing Mesh:

   a. Open-weave, glass fiber fabric treated for compatibility with other system materials.
   b. Provide for ultra high impact mesh assembly including Panzer 20 mesh for all EIFS clad wall areas within 8’-0” of grade and where additionally indicated on contract drawings.

c. Dryvit Standard Mesh: Glass fiber mesh used to reinforce wall areas above 8’-0” of grade, special shapes and irregular details.
d. Dryvit Detail Mesh: Glass fiber mesh used for high impact resistance with recesses, contours and grooves.
e. Dryvit Corner Mesh: Provide at all corners for additional impact resistance.

9. Trim Accessories: Plaster Components, Inc., VinylTech Starter Strip, Casing Beads, Expansion Joints, Corner Beads, Drop Caps etc., where indicated on the drawings and as required.

10. Finish:

a. Water-based, acrylic coating with integral color and texture; formulated with Dirt Pickup Resistance (DPR) chemistry; color and texture as selected be Architect from manufacturers full line of standard and custom colors and finishes.

11. Primers and Sealers:

a. Color Prime: A water based, pigmented, acrylic primer.
b. Prymit: A water based acrylic primer/adhesion promoter.

12. Coatings:

a. Demandit: A non-textured water based acrylic coating.

C. Joint Sealants:

1. Silicone Sealant: A non-sag, non-staining, neutral-curing silicone joint sealant as manufactured by Tremco Inc. Commercial Sealants and Waterproofing.

a. Spectrem 1: An ultra-low modulus, high-performance, one-part, moisture-curing silicone joint sealant with physical properties making it an ideal sealant for sealing dynamic joints.
b. Coordination for custom sealant colors are required.

D. Jobsite-Mixed Materials:

1. Portland cement: verify is Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.

2. Water: verify is clean and free of foreign matter.

E. Reference Documentation for Outsulation HDCI Securock ExoAir 430 System:

1. Data Sheet – DS908
2. Details – DS 911
3. Application Instructions – DS909

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Verify access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.

2. Verify the deflection of the substrate does not exceed 1/240 times the span. Verify substrate is flat within 1/4 in (6.4 mm) in a 4 ft (1.2 m) radius.

3. Verify substrate is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the Exterior Insulation and Finish System with moisture drainage installation or performance.

4. Verify the slope of inclined surfaces are not less than 6:12 (27 o) were the length of the slope does not exceed 12 in (305 mm) or 3:12 (14 o) were the length of the slope does not exceed 4 in (102 mm).

5. Verify metal roof flashings have been installed in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards.

6. Verify all rough openings are flashed in accordance with the Exterior Insulation and Finish System with Moisture Drainage manufacturer's installation details, or as otherwise necessary to prevent water penetration. Verify chimneys, balconies and decks have been properly flashed as necessary to prevent water penetration.

7. Verify windows and doors are installed and flashed per manufacturer's requirements and installation details.

8. Notify the Architect of all discrepancies prior to the installation of the Exterior Insulation and Finish System with moisture drainage. Work shall not proceed until unsatisfactory conditions are corrected.

9. Provide expansion joints at the following locations and at locations shown on the drawings.

    a. Where expansion joints occur in the substrate system.
    b. Where building expansion joints occur.
    c. At floor lines in wood frame construction.
    d. At floor lines of non-wood framed buildings where significant movement is expected.
    e. Where the High Durability Exterior Insulation and Finish System with Moisture Drainage abuts dissimilar materials.
    f. Where the substrate type changes.
    g. Where prefabricated panels abut one another.
    h. In continuous elevations at intervals not exceeding 75 ft.
    i. Where significant structural movement occurs, such as changes in roof line, building shape or structural system.

3.02 PREPARATION

A. Protect the Exterior Insulation and Finish System with Moisture Drainage materials by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.

B. Protect adjoining work and property during installation of the Exterior Insulation and Finish System with Moisture Drainage.

C. Prepare the substrate to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

3.03 INSTALLATION

A. Install the EIF system in accordance with ASTM C1397 and the Dryvit Outsulation Plus MD System

Application Instructions, DS934. Apply base coat sufficient to fully embed the reinforcing mesh. The recommended method is to apply the base coat in two (2) passes.

B. Apply sealant to base coat surface prepared in accordance with DS153.

C. Install high impact reinforcing mesh as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage as designated on contract drawings.

D. Install Machine Coated Dryvit EPS Shapes in accordance with Dryvit Publication DS854.

3.04 SITE QUALITY CONTROL

A. Exterior Insulation and Finish System with Moisture Drainage manufacturer assumes no responsibility for on-site inspections or application of its products.

B. EIFS sub-contractor to certify in writing the quality of work performed relative to the substrate system, details, installation procedures, and as to the specific products used.

C. EPS supplier, if requested, to certify in writing that the EPS meets the Exterior Insulation and Finish System with Moisture Drainage manufacturer’s specifications.

D. The sealant contractor, if requested, to certify in writing that the sealant application is in accordance with the sealant manufacturer's and the Exterior Insulation and Finish System with Moisture Drainage manufacturer’s recommendations.

3.05 CLEANING

A. Remove all excess Exterior Insulation and Finish System materials from the job site by the contractor in accordance with contract provisions and as required by applicable law.

B. Leave all surrounding areas, where the Exterior Insulation and Finish System with Moisture Drainage has been applied, free of debris and foreign substances resulting from the EIFS sub-contractor’s work.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072423 – DIRECT APPLIED EXTERIOR FINISH SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This document is intended to be used in preparing specifications for projects utilizing Cement Board MD Finish System by Dryvit. For complete product description and usage refer to:

1. Dryvit Cement Board MD Data Sheet, DS480.
2. Dryvit Cement Board MD Installation Details, DS190.

1.02 RELATED DOCUMENTS

B. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

C. Related Sections:

1. Section 033000 – Cast-in-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 054000 – Cold Formed Metal Framing
4. Section 061000 – Rough Carpentry
5. Section 061643 – Exterior Gypsum Sheathing
6. Section 076000 – Flashing and Sheet Metal
7. Section 079200 – Joint Sealants

1.03 REFERENCE STANDARDS

A. ICC Evaluation Service:

1. AC59 Acceptance Criteria for Direct-Applied Exterior Finish Systems
2. AC148 Acceptance Criteria for Flashing Materials

B. ASTM Standards:

1. ASTM B 117 - (Federal Test Standard 141A Method 6061) Test Method of Salt Spray (Fog) Testing
2. ASTM C 150 - Specification for Portland Cement
3. ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
4. ASTM C 1325 - Standard Specification for non-asbestos fiber-mat reinforced cementitious backer units
5. ASTM C 1516 - Standard Practice for Application of Direct-Applied Exterior Finish Systems
6. ASTM D 968 - (Federal Test Standard 141A Method 6191) Test Method for Abrasion Resistance of Organic Coatings by Falling Abrasive
7. ASTM D 2898 - Standard Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
8. ASTM D 3273 - Test Method for Resistance to Growth of Mold on Surfaces
9. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
10. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials
11. ASTM G 23 (Federal Test Standard 141A Method 6151) Recommended Practice for Operating Exposure Apparatus (Carbon-Arc Type) With and Without Water, for Exposure of Nonmetallic Materials

1.04 SUBMITTALS

A. Submit product data as required by Section 013300 – Submittal Procedures.

B. Submit one sample of each finish requested of DEFS Systems for approval. Color and texture shall be approved based on job site samples or specific submitted samples, and as indicated on the drawings.

C. Applying contractor of the system shall submit complete shop drawings for the DEFS panels including erection drawings and details.

D. Applying contractor of the DEFS Systems will submit evidence with the bid that he is manufacturer's approved applicator of the system.

E. Submit a copy of the manufacturer’s installation details and application instructions.

F. Submit a copy of the manufacturer’s recommended maintenance and repair manual.

1.05 DESCRIPTION

A. Cement Board MD Finish System consisting of Dryvit base coat with reinforcing mesh, and finish applied over an approved sheathing that is installed over a code approved water-resistive barrier and approved drainage medium. The substrate, glass mat sheathing or cement board, and water-resistive barrier (unless the water-resistive barrier is manufactured by Dryvit) are not part of the system.

1. Design Requirements.

a. A sheathing board substrate installed over structural framing prior to installation of a code approved water-resistive barrier shall be one of the following:

1) Exterior sheathing having a water-resistant core with fiberglass mat facers meeting ASTM C 1177.

2) Exterior fiber reinforced cement meeting ASTM C 1325 or calcium silicate boards.

3) APA Exterior or Exposure 1 Rated Plywood, Grade C-D or better, nominal 1/2 in (12.7 mm), minimum, installed with the C face out.

4) APA Exterior or Exposure 1 Fire Retardant Treated (FRT) Plywood, Grade C-D or better, nominal 1/2 in (12.7 mm), minimum, installed with the C face out.

b. The outer layer sheathing shall be exterior cement board meeting ASTM C 1325, minimum 1/2 in.

c. The roofing materials shall be loaded onto the roof and interior wallboard stocked in the building prior to the installation of the Cement Board MD Finish System.

d. Deflection of substrate systems shall not exceed L/360.

e. The slope of inclined surfaces shall not be less than 6:12 (27°) and the length shall not exceed 12 in.

f. Expansion joints:

1) Design and location of expansion/control joints in the substrate shall be determined by

the project design professional and indicated on the contract documents. As a minimum, joints in Cement Board MD Finish System are required at the following locations:

a) Where expansion joints occur in the substrate system
b) Where building expansion joints occur
c) At floor lines in wood frame construction
d) Where Cement Board MD Finish System abuts dissimilar materials
e) Where the substrate changes
f) Where significant structural movement occurs such as changes in roofline, building shape or structural system

g. Control joints:

1) Design and location of control joints shall be determined by the design professional. As a minimum, control joints shall be located at the following locations:
   a) Corners of openings.
   b) Such that wall lengths do not exceed 20 ft.
   c) Length to width ratios of wall areas shall not exceed 2.5:1.

h. Sealants:

1) Use and location of sealants is the responsibility of the project designer and shall be indicated on the contract documents.
2) Refer to Section 079200.
3) Refer to Dryvit publication DS153 for a list of sealants that have been tested for compatibility with Dryvit products.

i. Vapor Retarders:

1) Use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. Type and location shall be noted on the contract documents. Vapor retarders may be inappropriate in certain climatic zones and can result in condensation within the wall assembly when incorrectly used. Refer to Dryvit publication DS159 for additional information.

j. Flashing:

1) Flashing: shall be provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies, and other areas as necessary to prevent water penetration behind Cement Board MD Finish System.

k. Site Coated EPS Shapes and Starter Boards: Shall be coated on site utilizing the same materials (EPS, base material mixture, reinforcing mesh, and finish) as specified for the project.

l. Machine Coated EPS Shapes and Starter Boards: Shall be supplied by a manufacturer that subscribes to the Dryvit third party certification and quality assurance program.

2. Performance Requirements: As a minimum, the Dryvit Cement Board MD Finish System products shall be tested as follows:

a. ASTM B 117: Salt Spray Resistance – 300 hrs, no deleterious effects.
b. ASTM C 297 Bond Strength – Failure in the substrate.
c. ASTM D 968: Abrasion Resistance – 132 gal (500 L), no deleterious effects.

d. ASTM D 3273 Mildew/Fungus Resistance – Passed.
e. ASTM E 84 Flame Spread – Flame Spread Index less than 25, Smoke Developed less than 250.
   ASTM E 96 Water Vapor Transmission – Vapor Permeable.
f. ASTM G 23 Accelerated Weathering – 2000 hrs, Passed

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Shall be Dryvit Systems, Inc. or approved suppliers. All materials shall be obtained from Dryvit Systems, Inc. or its authorized distributors.

2. Material shall be manufactured at a facility covered by a current ISO 9001:2015 and ISO 14001:2015 certification. Certification of the facility shall be by a registrar accredited by the American National Standards Institute-Registrar Accreditation Board (ANSI-RAB).

3. Plastering Contractor:

   a. Shall be knowledgeable in the proper installation of Cement Board MD Finish System components.
   b. Shall have qualified and properly trained people to perform work.
   c. Shall be licensed, bonded and insured.
   d. Shall have experience in application of direct-applied exterior finish systems on projects of comparable scope.

4. Third Party Inspection:

   a. Owner's independent third-party inspection is recommended to verify installation according to code and contract documents. It is recommended that as a minimum, inspection items include installation of the water-resistive barrier, flashings and accessories, Cement Board MD Finish System materials and sealants. The intent is to verify that the installation has been performed in accordance with code requirements, contract requirements and this specification.

5. Machine Coated EPS Shapes and Starter Boards: Shall be supplied by a manufacturer that subscribes to the Dryvit third party certification and quality assurance program.

B. Mock-Up:

1. The contractor shall, before the project commences, provide the owner/architect with a mock-up for approval.

2. The mock-up shall be of suitable size as required to accurately represent each color and texture to be utilized on the project.

3. The mock-up shall be prepared with the same products, tools, equipment and techniques required for the actual applications. The finish used shall be from the same batch as that being used for the project.

4. The approved mock-up shall be available and maintained at the job site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. All Dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.

B. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.

1. Materials shall be stored at the job site, and at all times, in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Minimum storage temperature shall be as follows:

a. DPR, PMR™, HDP™, Weatherlastic® and E™ Finishes, Color Prime™, Primus®, Genesis® and NCB™,40 °F.
b. For other products, refer to specific product data sheets.

2. Maximum storage temperature shall not exceed 100 °F.

C. Protect all products from inclement weather and direct sunlight.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:

1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.

2. At the time of Dryvit product application, the air and wall surface temperatures shall be from 40 °F (4 °C) minimum to 100 °F (38 °C) maximum for the following products:

a. DPR, PMR, HDP, Weatherlastic and E Finishes, Color Prime, Primus, Genesis and NCB.
b. For other products, refer to specific product data sheets.

3. These temperatures shall be maintained with adequate air ventilation and circulation for a minimum of 24 hours (48 hours for Weatherlastic Finishes, Ameristone, and TerraNeo) thereafter, or until the products are completely dry. Refer to published product data sheets for more specific information.

B. Existing conditions: The Applicator shall have access to electric power, clean water, and a clean work area at the location where the EIFS materials are being stored.

C. Sequencing and Scheduling:

1. Installation of Cement Board MD Finish System shall be coordinated with other construction trades.

2. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.09 WARRANTY

A. Dryvit Systems, Inc. shall provide a written limited materials warranty against defective material upon written request. Dryvit shall make no other warranties, expressed or implied. Dryvit does not warrant workmanship. Full details are available from Dryvit Systems, Inc.

B. The applicator shall warrant workmanship per Section 017000. Dryvit shall not be responsible for workmanship associated with installation of the Cement Board MD Finish System.

1.10 MAINTENANCE

A. All Dryvit products are designed to require minimal maintenance. However, as with all building

products, depending on location, some cleaning and minimal maintenance may be required. See Dryvit publication DS152 on Cleaning and Recoating.

B. Sealants and flashings shall be inspected by the owner or their agent on a regular basis and repairs made as necessary.

PART 2 - PRODUCTS

2.01 GENERAL

A. For the purposes of this specification the EIFS System has been based upon products as manufactured by Dryvit Systems, Inc., One Energy Way, West Warwick, RI 02893, 800-556-7752, www.dryvit.com. Terminology references this manufacturer's products as it related to their system.

B. All components of the Cement Board MD Finish System shall be obtained from Dryvit or its authorized distributors. Substitutions or additions of materials manufactured or supplied by others will void the EIF system warranty.

C. Alternate EIFS manufacturers must demonstrate equivalency for all elements of EIF system such as but not limited to:

1. Material components, compatibility and testing
2. Standard and specialty finishes;
3. Color and texture matching; and,
4. Warranty criteria as specified herein

2.02 MATERIALS

A. Water-Resistive Barrier (not a component of the Dryvit finish system except for Backstop® NT™):

1. Dryvit Backstop NT: A vapor permeable, flexible, polymer-based noncementitious water-resistive and air barrier coating available in Texture, Smooth, and Spray. See DS180 and DS181.

2. Dryvit Backstop NT-VB: A Class 1 vapor retarder, available in trowel and spray versions. When specified, consider having a WVT analysis performed. See DS830 and DS831.

3. Dryvit Grid Tape™: A 4 in (102 mm) wide, open weave fiberglass mesh tape used to reinforce sheathing joints and exposed edges of sheathing.

4. Other code approved water-resistive barrier (when selected by others) is not a component of the Dryvit finish system.

B. Dryvit MD Spacer™: A polyethylene spacer, which separates the exterior cement board from the sheathing substrate. If other spacers are used, they are not part of the Dryvit finish system.

C. Exterior Sheathing are not components of the Dryvit finish system; refer to Section 061643.

D. Dryvit Base Coat:

1. Cementitious: A liquid polymer based material, which is field mixed in a 1:1 ratio by weight with Portland Cement.

a. Shall be Genesis®.

E. Machine Coated EPS Shapes and Starter Boards: Shall be supplied by a manufacturer that subscribes to the Dryvit third party certification and quality assurance program.

F. Reinforcing Mesh: Shall be a balanced open weave, glass fiber fabric treated for compatibility with other system materials.

1. Dryvit Detail Mesh®: 4.3 oz/yd^2, 9 1/2 in wide. Required at all exterior cement board joints and inside and outside corners.

2. Dryvit Standard Mesh: 4.3 oz/yd^2. Shall be installed over the entire exterior sheathing board face.

G. Dryvit Finish: Shall be the type, color and texture as selected by the owner/architect and shall be one or more of the following:

1. Water-based, acrylic coating with integral color and texture; formulated with Dirt Pickup Resistance (DPR) chemistry; color and texture as selected be Architect from manufacturers full line of standard and custom colors and finishes.

H. Primers and Sealers:

1. Color Prime: A water based, pigmented, acrylic primer.

2. Prymit: A water based acrylic primer/adhesion promoter.

I. Coatings:

1. Demandit: A non-textured water based acrylic coating.

J. Expanded polystyrene (if applicable): Shall be 1 pcf nominal density meeting DS131. EPS must meet the specification of Dryvit Systems, Inc. and be produced by a manufacturer licensed by Dryvit.

K. Accessories (by others) are not components of the Dryvit finish system.

1. Type, style and manufacturer shall be indicated on construction documents.

2. In corrosive environments, accessories manufactured of PVC or zinc are recommended.

3. Steel accessories shall meet ASTM C 841.

4. PVC accessories shall meet ASTM D 1784 and C 1063.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of the Cement Board MD Finish System, it is the contractor's responsibility to ensure that:

1. The sheathing substrate is of a type listed in Section 1.05 A.1.a.

2. The sheathing substrate and the surface are free of dust, loose particles, oil and other conditions that would affect the adhesion or installation of Cement Board MD Finish System materials.

3. All fasteners are corrosion resistant and installed in a manner as to be flush with the surface of the sheathing.

4. All accessories including corner aids, control and expansion joints, casing beads, etc. are properly fastened and positioned according to contract drawings, manufacturer requirements and local building code requirements.

5. The water-resistive barrier is of a proper type and, if sheet form, has been installed in a weatherboard fashion in accordance with building code and manufacturer's requirements.

6. Doors, windows, decks, and other openings and penetrations have been properly flashed in accordance with manufacturer requirements, building code and contract documents.

7. Metal roof flashing has been installed in accordance with Asphalt Roofing Manufacturers Association (ARMA) Standards.

8. The sheathing board surface is flat within 1/4 in (6.4 mm) in 10 ft (3 m).

9. The contractor shall notify the general contractor and/or owner and/or architect of all discrepancies. Do not proceed until unsatisfactory conditions are resolved.

10. Provide expansion joints at the following locations and at locations shown on the drawings.

    a. Where expansion joints occur in the substrate system.
    b. Where building expansion joints occur.
    c. At floor lines in wood frame construction.
    d. At floor lines of non-wood framed buildings where significant movement is expected.
    e. Where the Cement Board MD Finish System abuts dissimilar materials.
    f. Where the substrate type changes.
    g. Where prefabricated panels abut one another.
    h. In continuous elevations at intervals not exceeding 75 ft.
    i. Where significant structural movement occurs, such as changes in roof line, building shape or structural system.

3.02 PREPARATION

A. The Cement Board MD Finish System materials shall be protected by permanent or temporary means from weather and other damage prior to, during, and following application, until dry.

B. Protect adjoining work and property.

C. Prepare the substrate to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

3.03 INSTALLATION

A. Mixing:

1. Backstop NT: Due to shipping and storage, there may be some settling of materials. Prior to using, mix the material to a smooth homogeneous consistency.

2. Dryvit base coat materials shall be mixed in accordance with current Dryvit printed Product Sheets.

    a. Dryvit Genesis shall be mixed in a 1:1 ratio with Portland cement. The mix is allowed to

set for 5 minutes and then remixed to break the set. Refer to Genesis product sheet DS417 for complete instructions.

b. Dryvit Genesis DM shall be mixed with water to a uniform consistency, allowed to set for 10 minutes and then remixed to break the set. Refer to Genesis DM product sheet DS452 for complete instructions.
c. Dryvit Genesis DMS shall be mixed with water to a uniform consistency, allowed to set for 5 minutes and then remixed to break the set. Refer to Genesis DMS product sheet DS471 for complete instructions.

3. Dryvit Finishes:

a. Dryvit Finishes are factory blended and require no additives. Mix each pail to a uniform consistency adding a small amount of water as needed to adjust workability. Ensure that the same amount of water is added to each pail of the same color.
b. Refer to the product data sheet for the specific finish being used for more complete instructions.

B. Application of Backstop NT:

a. Prepare the substrate sheathing so as to be free of foreign materials such as oil, dust, dirt, paint, wax, water repellents, moisture, frost and any other materials that may inhibit adhesion.
b. Backstop NT can be applied using a roller, trowel, or spray equipment (with backrolling) over the approved substrates. Refer to Backstop NT Application Instructions, DS181.

C. Installation of Dryvit MD Spacer:

1. Secure the Dryvit MD Spacer to the substrate using corrosion resistant staples through the water-resistive barrier and into the substrate or framing. The spacer is 1/8 in (3.2 mm) thick by 3 in (76 mm) wide and is installed in continuous vertical strips spaced a maximum of 16 in (406 mm) on center installed over each framing member. Additionally, install the spacer flush with the vertical edge of all system terminations and changes in wall direction. If other spacers are used, follow manufacturers' instructions.

D. Install the exterior cement board in accordance with manufacturer's instructions and project requirements.

1. Align sheathing joints with the MD Spacer and install fasteners through the MD Spacer or other spacers as needed.

2. Do not align joints with corners of wall penetrations.

3. Exterior cement board joints shall be offset from sheathing board substrate joints.

E. Foam shape application (if applicable)

1. Adhere EPS shape to exterior cement board prior to applying the base coat.

2. Install in accordance with current Dryvit printed Outsulation® System Application Instructions DS204.

F. Application of Base Coat:

1. Apply Genesis or Genesis DM over all exterior cement board joints and inside and outside corners and embed a 9 1/2 in (241 mm) wide strip of Dryvit Detail Reinforcing Mesh into the wet base coat mixture.

2. Allow the base coat mixture to take up until firm to the touch.

3. Apply a continuous layer of Genesis, Genesis DM or Genesis DMS over the exterior cement board face and embed a layer of Dryvit Standard Reinforcing Mesh into the wet base coat mixture such that the entire surface of the board is covered. The reinforced base coat shall be applied to a uniform thickness of approximately 1/16 in (1.6 mm) and be sufficient to embed the reinforcing mesh.

4. All edges of reinforcing mesh shall be lapped a minimum of 2 1/2 inches (64 mm).

G. Application of Finishes:

1. Allow the Genesis, Genesis DM or Genesis DMS to cure a minimum of 24 hours until completely dry.

2. Ensure that the surface of the wall is clean, dry and free of any contaminants that may impair the adhesion of surface finish.

3. Dryvit finishes may be either spray or trowel applied.

4. Always apply the finish to a natural break to avoid visible cold joints.

5. Always work the shady side of the wall or provide shading to avoid application in direct sunlight.

6. Dryvit finishes shall be applied in accordance with published Dryvit instructions for the specific finish being used. Refer to the published product data sheet for the specified finish.

H. The installation of Pre-Coated EPS Shapes and Starter Boards shall be in accordance with Dryvit Publication DS854.

3.04 FIELD QUALITY CONTROL

A. The contractor shall be responsible for the proper application of the Cement Board MD Finish System materials.

B. Independent third party inspection is required to verify installation according to code and contract documents. As a minimum, it is recommended that inspection items include installation of the water-resistive barrier, flashings, and accessories, Cement Board MD Finish System materials, and sealants.

3.05 CLEANING

A. All excess Cement Board MD Finish System materials shall be removed from the job site by the contractor in accordance with contract provisions.

B. All surrounding areas, where the Cement Board MD Finish System has been applied, shall be left free of debris and foreign substances resulting from the contractor's work.

3.06 PROTECTION

A. The system shall be protected from weather and other damage until permanent protection in the form of flashings, sealants, etc. are installed.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072500 – GYPSUM BOARD WEATHER-RESISTANT BARRIER & AIR BARRIER SYSTEM

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Work of this section includes coated fiberglass-mat gypsum sheathing board system with integral weather-resistant barrier (WRB) and air barrier (AB) features, and all accessory materials required for covering sheathing joints, fasteners, penetrations, rough openings, and material transitions, for use under exterior wall claddings.

B. Fluid-applied membrane air barrier.

1.02 RELATED SECTIONS

A. Section 054000 - Cold-Formed Metal Framing
B. Section 061000 - Rough Carpentry
C. Section 079200 - Joint Sealants
D. Section 092900 - Gypsum Wall Board

1.03 DEFINITIONS

A. Air Barrier (AB): Air tight barrier made of material that is relatively air impermeable but moisture vapor permeable, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

B. Weather-Resistant Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

C. Rough Openings: Openings in the wall to accommodate windows and doors.

D. Material Transitions: Areas where the WRB / AB coated fiberglass-mat gypsum sheathing connects to beams, columns, slabs, parapets, foundation walls, roofing systems, and at the interface of dissimilar materials.

1.04 REFERENCE STANDARDS

A. ASTM C473 - Standard Test Method for Physical Testing of Gypsum Panel Products.
B. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
C. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
E. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
F. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
G. ASTM E119 - Standard Test Method for Fire Tests of Building Construction and Materials.
H. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 C.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
J. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
K. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
L. ICC ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing.
M. AAMA 714 - Voluntary Specification for Liquid Applied Flashing Used to Create a Water Resistive Seal Around Exterior Wall Openings in Buildings.

1.05 SUBMITTALS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

B. Product Data and Installation Instructions: Submit manufacturer's product data including sheathing and accessory material types, composition, descriptions and properties, installation instructions and substrate preparation recommendations.

C. Shop Drawings: Submit shop drawings indicating locations and extent of WRB / AB system, including details of typical conditions, special joint conditions, intersections with other building envelope systems and materials; counterflashings and details showing bridging of envelope at substrate changes, details of sealing penetrations, and detailed flashing around windows and doors.

D. Test Reports: Submit test reports indicating compliance with specified performance characteristics and requirements.

E. Sample warranty: Submit a sample warranty identifying the terms and conditions of the warranty as herein specified.

F. Evaluation reports: Accredited laboratory testing for materials.

1.06 WARRANTY

A. Provide manufacturer's exposure warranty that offers twelve (12) months of coverage against in-place exposure damage (delamination, deterioration) beginning with the date of installation of the product.

B. Provide manufacturer's standard warranty for sheathing to be free of manufacturing defects that make it unsuitable for its intended use. Warranty period shall be ten (10) years from the date of purchase of the product.

C. Provide manufacturer's standard warranty for use as a drainage plane when the cladding systems are properly designed and installed, with a warranty period of 10 years from the date of purchase of the product or, when used as a substrate in architecturally specified drainage EIFS, 12 years from the date of purchase of the product.

D. Material Warranty: Provide material manufacturer's standard product warranty, for a minimum three (3) years from date of Substantial Completion. SPEC NOTE: VERIFY WARRANTY LENGTH WITH MANUFACTURERS SPECIFIED

1.07 QUALITY ASSURANCE- MOCK UP

A. Install WRB / AB sheathing with sealed joints and penetrations in mock-up.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store WRB / AB coated fiberglass mat gypsum sheathing under cover and keep dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack sheathing flat and supported on risers on a flat platform to prevent sagging.

B. Protect fluid applied material, primers and accessory materials from damage, weather, excessive temperatures and construction traffic.

C. Store fluid applied material and primers at temperatures of 40 degrees F or above.

D. Apply fluid applied material to clean surfaces free of contaminants. Chemical residues, surface coatings or films may adversely affect adhesion. Pressure-treated wood and other contaminated surfaces should be cleaned with a solvent wipe before application.

1.09 FIELD CONDITIONS

A. Application standards where applicable are in accordance with Gypsum Association Publication GA-253 for gypsum sheathing and ASTM C1280.

B. Do not install sheathing that is moisture damaged. Indications that panels are moisture damaged include, but not limited to, discoloration, sagging, or irregular shape.

C. Allow installed sheathing to be dry to the touch before sealing joints, penetrations, rough openings, and material transitions.

D. Do not attempt to seal joints, corners, penetrations, rough openings, and material transitions when installed sheathing surface is frozen or has frost on the surface.

E. Do not apply sealing materials to sheathing when air or surface temperature is below 25F for fluid applied materials.

F. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

G. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.

H. Ultra-violet exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

PART 2 - PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Acceptable products: DensElement Barrier System as manufactured by Georgia-Pacific Gypsum, LLC; or architect approved equal.

1. Sheathing: DensElement Sheathing.

2. Fluid-applied flashing materials: Fluid-applied flashing as approved by Georgia-Pacific Gypsum, LLC.

3. Primers, backer rods and accessory materials: As approved by Georgia-Pacific Gypsum, LLC.

B. System Description: Weather-Resistant Barrier and Air Barrier assembly installed at exterior stud walls under exterior cladding, consisting of the following components as herein specified:

1. Sheathing: WRB / AB coated fiberglass mat gypsum sheathing.

2. Fluid-applied flashing to seal sheathing joints, inside and outside corners, penetrations, rough openings, and material transitions.

3. Primer to seal raw gypsum edges before applying fluid applied flashing.

4. Backer rods and accessory materials.

2.02 WEATHER-RESISTANT BARRIER (WRB) AND AIR BARRIER (AB) GYPSUM SHEATHING

A. Description: Coated fiberglass mat gypsum sheathing with integral weather-resistant barrier (WRB) and air barrier (AB) complying with applicable requirements of ICC ES AC 212, ASTM E2178, ASTM E2357.

B. Vapor Permeability: When tested as system in accordance with ASTM E96 (water method) the WRB and AB system has a minimum vapor permeance of 20 perms with sealed joints and fasteners.

C. The WRB and Air Barrier Gypsum Sheathing has a moisture absorption rate < 6%.

D. Air Barrier performance requirements:

1. Air permeance of sheathing: Sheathing with an air permeability not greater than 0.001 cfm/ft2 (0.02L/s/m2) when tested in accordance with ASTM E2178.

2. Air permeance of assembly: Assembly of sheathing and sealing components with an average air leakage not greater than 0.04 cfm/ft2 (0.2L/s/m2) when tested in accordance with ASTM E2357.

2.03 FLUID-APPLIED FLASHING AND ACCESSORY MATERIALS FOR JOINTS, INSIDE AND OUTSIDE CORNERS, FASTENERS, ROUGH OPENINGS, AND MATERIAL TRANSITIONS

A. Substrate requirements:

1. Sheathing panels should be trimmed to obtain neat fitting joint.

2. Gaps that are more than 1/4” and less than 1” shall be filled with a backer rod to support the fluid applied flashing at the transition joint.

3. For gaps larger than 1" use transition membrane flashing as approved by Georgia-Pacific Gypsum LLC.

B. Fluid applied flashing for panel joints, inside and outside corners, and penetrations:

1. Description: STP-based fluid applied flashing.

2. Properties:

a. Acceptable substrate: Georgia-Pacific Gypsum LLC DensElement Sheathing.
b. Adhesion to fiberglass mat faced sheathing: No delamination from face of sheathing.
c. Applied wet film thickness: 16 mils.
d. Air permeance: meets 0.004 cubic feet per minute per square foot (0.02L/s/sq m), maximum, when tested in accordance with ASTM E2178.
e. Water vapor permeance: >10 perms (287 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.
f. Ultraviolet and weathering resistance: Approved for 12 months weather exposure.
g. Comply with applicable requirements of AAMA 714

3. Primer: Provide primer in accordance with air barrier manufacturer's written instructions for exposed gypsum core edges.

C. Fluid applied flashing for sealing fasteners:

1. Description: STP-based fluid applied flashing.

2. Properties:

a. Acceptable substrate: Georgia-Pacific Gypsum LLC DensElement Sheathing.
b. Adhesion to fiberglass mat faced sheathing: No delamination from face of sheathing.
c. Applied wet film thickness: 16 mils.
d. Air permeance: meets 0.004 cubic feet per minute per square foot (0.02L/s/sq m), maximum, when tested in accordance with ASTM E2178.
e. Water vapor permeance: >10 perms (287 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.
f. Ultraviolet and weathering resistance: Approved for 12 months weather exposure.
g. Comply with applicable requirements of AAMA 714.

D. Fluid applied flashing for sealing rough openings

1. Fluid applied flashing: STP-based fluid applied flashing.

2. Primer: Liquid primer in accordance with air barrier manufacturer's written instructions for exposed gypsum core edges. Apply primer to raw gypsum board edges by brushing on a thin, uniform coat.

3. Properties:

a. Acceptable substrate: Georgia-Pacific Gypsum LLC DensElement Sheathing.
b. Flashing adhesion to fiberglass mat faced sheathing: No delamination from face of sheathing.
c. Applied wet film thickness: 16 mils.
d. Flashing air permeance: meets 0.004 cubic feet per minute per square foot (0.02L/s/sq m), maximum, when tested in accordance with ASTM E2178.
e. Flashing water vapor permeance: >10 perms (287 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.
f. Ultraviolet and weathering resistance: Approved for 12 months weather exposure.
g. Flashing comply with applicable requirements of AAMA 714.

E. Material transitions using fluid applied flashing:

1. Refer to substrate requirements for treatment of gaps as specified herein. Gaps that are more than 1/4” and less than 1” shall be filled with a backer rod to support the fluid applied flashing at the transition joint. For gaps larger than 1" use transition membrane flashing as approved by Georgia-Pacific Gypsum LLC.

2. Fluid applied flashing for material transitions: Water based fluid applied flashing.

3. Properties:

a. Acceptable substrate: Georgia-Pacific Gypsum LLC DensElement Sheathing.
b. Adhesion to fiberglass mat faced sheathing: No delamination from face of sheathing.
c. Applied wet film thickness: 16 mils
d. Air permeance: 0.004 cubic feet per minute per square foot (0.02L/s/sq m), maximum, when tested in accordance with ASTM E2178
e. Water vapor permeance: >10 perms (287 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M
f. Ultraviolet and weathering resistance: Approved for 12 months weather exposure.
g. Comply with applicable requirements of AAMA 714

PART 3 - EXECUTION

3.01 PREPARATION

A. Remove projections, protruding fasteners, loose or damaged sheathing material at edges of panel that might interfere with proper installation to seal joints, corners, fasteners, penetrations, openings, or material transitions.

B. Wipe down the sheathing surface to receive sealing materials with a clean cloth.

C. Ensure field conditions are met as outlined in Part 1 – General Requirements.

3.02 INSTALLATION OF WEATHER-RESISTANT BARRIER (WRB) AND AIR BARRIER (AB) SHEATHING

A. WRB / AB Coated fiberglass mat sheathing:

1. Install and fasten DensElement Sheathing according to manufacturer’s detailed installation instructions.

2. Fastener and penetration treatment: Treat all sheathing fasteners with specified fluid applied flashing used for sealing joints.

3.03 FLUID APPLIED FLASHING FOR SEALING SHEATHING JOINTS, INSIDE AND OUTSIDE CORNERS, FASTENERS, ROUGH OPENINGS, AND MATERIAL TRANSITIONS

A. Sealing DensElement Sheathing Joints using specified Fluid Applied Flashing

1. Apply fluid applied flashing over the joint in a zigzag or ribbon pattern. Cover a minimum of 1” on both sides of the joint.

2. With a straight edge tool, spread evenly over the sheathing joint.

3. Apply at a rate to achieve a minimum wet mil thickness of 16 mils over the entire joint area.

B. Sealing DenElement Sheathing Vertical Corners using specified Fluid Applied Flashing:

1. Prime exposed gypsum edges with specified primer.

2. Apply fluid applied flashing over the inside and/or outside corner in a zigzag or ribbon pattern. Cover a minimum of 2” on both sides of the corner.

3. With a straight edge tool, spread evenly over the sheathing corner.

4. Apply at a rate to achieve a minimum wet mil thickness of 16 mils over the corner area.

C. Sealing DensElement Sheathing Fasteners using specified Fluid Applied Flashing: Apply the fluid applied flashing material to fasteners and wipe down with a straight edge tool; provide a minimum 16 mil thick coating over the fastener.

D. Sealing DensElement Sheathing Rough Openings using specified Fluid Applied Flashing:

1. Prime exposed gypsum edges with specified primer.

2. Apply a bead of DensDefy™ Liquid Flashing into all inside corners of the opening.

3. Apply fluid applied flashing onto:

   a. Sills of openings
   b. Jambs of openings
   c. Headers of openings

4. Apply DensDefy™ Liquid Flashing in the opening sill, jamb and header in a zig-zag or ribbon pattern.

5. Apply DensDefy™ Liquid Flashing over the DensElement Sheathing adjacent to the opening sill, jamb and header in a zig-zag or ribbon pattern.

6. Use a straight edge tool to spread the DensDefy™ Liquid Flashing to a pinhole void free application achieving a minimum 16 wet mils.

7. Spread the DensDefy™ Liquid Flashing a minimum of 2” into the rough opening and a minimum 1” past the interior air seal of the window unit. Refer to the project details and specifications to determine window placement and minimum requirement for rough opening treatment.

8. Ensure a minimum 2” of DensDefy™ Liquid Flashing is applied onto the sheathing surface adjacent to the opening.

E. Sealing DensElement sheathing material transitions using specified Fluid Applied Flashing

1. Sheathing joint and transition gaps to receive fluid-applied flashing shall be less than 1/4".

2. For gaps larger than 1/4" use shall be sealed with fluid-applied flashing as approved by Georgia-Pacific Gypsum, LLC.

3. Gaps that are more than 1/4” and less than 1” shall be filled with a backer rod to support the fluid applied flashing at the transition joint.

4. If necessary, prime the adjacent material with primer per the material manufacturer's recommendations.

5. Apply fluid applied flashing over the sheathing and adjacent material in a zigzag or ribbon pattern. Ensure the flashing is a minimum of 2" on each substrate material surface.

6. With a straight edge tool, spread fluid applied flashing over material transition joint.

7. Apply at a rate to achieve a minimum wet mil thickness of 16 mils.

3.04 SEALING EXTERIOR WALL PENETRATIONS

A. Exterior wall penetration shall be sealed to prevent air and water infiltration. Penetrations may be sealed with fluid applied flashing.

B. For round or square pipe/duct penetrations use specified fluid applied flashing, refer to DensElement Barrier System Technical Guide for instructions for proper sealing.

3.05 FIELD QUALITY CONTROL

A. Do not cover installed WRB / AB assembly until required inspections have been completed and installation has been accepted.

B. Where applicable, allow for owner's inspection and air barrier testing and reporting.

3.06 PROTECTION

A. Protect WRB / AB assembly from damage during installation and during the construction period.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072600 – VAPOR RETARDERS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work specified in this section covers furnishing, delivery, and installation of a vapor barrier under all new interior slabs on grade (horizontal application).

B. Products supplied under this section:

1. Vapor Barrier and installation accessories for installation under concrete slabs.

C. Related Sections:

1. Section 033000 – Cast-in-Place Concrete.
2. Section 072100 – Building Insulation

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM E 1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
2. ASTM E1643-18a Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
3. ASTM E1993-98 - Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
4. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
5. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
6. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. American Concrete Institute (ACI)

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.03 SUBMITTALS

A. Quality Control/Assurance

1. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

2. Summary of test results per paragraph 9.3 of ASTM E1745.

3. Manufacturer’s samples and literature

4. Manufacturer’s installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.

5. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

1.04 QUALITY ASSURANCE

A. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

B. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

C. Manufacturer verify in writing 20 years in the industry with no reported product failures.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Stack membrane on smooth ground or wood platform to eliminate warping.

D. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

D. Product not intended for uses subject to abuse or permanent exposure to the elements.

E. Do not apply on frozen ground.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Typical Interior Slabs Vapor Barrier: Under typical interior concrete slabs where finished flooring does not involve wood, provide non-woven, polyester, reinforced, polyethylene coated sheet of 15 mil thickness.

1. Vapor Barrier Products:

   a. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
   b. Or Architect approved equal.

2. Vapor Barrier membrane must have the following properties:

   a. Maintain permeance of less than 0.01 Perms [grains/(ft2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
   b. Other performance criteria:

      1) Strength: ASTM E1745 Class A.
      2) Thickness: 15 mils minimum.

   c. Provide third party documentation that all testing was performed on a single production roll

per ASTM E1745 Section 8.1.

d. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

B. Under Wood Floors Interior Slabs Vapor Barrier: Vapor Barrier under interior concrete slabs where finished flooring involves wood assemblies such as gymnasiums and stages provide Bituminous Vaporproofing/Waterproofing Membrane:

1. Vapor Barrier Products:

a. Basis of Design: Premoulded Membrane® Vapor Seal with Plasmatic Core by W.R Meadows. W.R. Meadows, Inc., PO Box 338, Hampshire Illinois 60140-0338. (800) 342-5976. (847) 683-4500.Fax (847) 683-4544. website www.wremeadows.com.

b. Or Architect approved equal.

2. Vapor Barrier must be seven-ply, weather-coated, permanently bonded, semi-flexible bituminous core board composed of a 3-ply plasmatic matrix sealed between liners of asphalt-impregnated felt and a glass mat liner. Vapor Barrier shall consist of an asphalt weather coat and covered with a polyethylene anti-stick sheet. Vapor Barrier shall meet or exceed all requirements of ASTM E 1993-98 and shall have the following characteristics:

a. Minimum Permeance ASTM F1249, calibrated to ASTM E96, Water Method: 0.0011 Perms.

b. Tensile Strength ASTM E154, Section 9: 156 LBS. Force/Inch.

c. Puncture Resistance ASTM E154: 149 LBS. Force.

2.02 ACCESSORIES

A. Typical Interior Slabs Vapor Barrier Accessories: by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com

1. Seams:

a. Stego Tape

2. Sealing Penetrations of Vapor barrier:

a. Stego Mastic

b. Stego Tape

3. Perimeter/edge seal:

a. Stego Crete Claw

b. Stego Term Bar

c. StegoTack Tape (double-sided sealant tape)

d. One-sided seaming tape is not a recommended method of sealing at the terminated edge.

4. Penetration Prevention:

a. Beast Foot

b. Beast Form Stake

5. Vapor Barrier-Safe Screed System:

a. Beast Screed

b. Beast Hook

B. Under Wood Floors Interior Slabs Vapor Barrier Accessories:

1. Bonding Asphalt: Catalytic Bonding Asphalt or Hydralastic 836.

2. Adhesive: Pointing Mastic.

3. Joint Tape: PMPC Tape.

4. Pointing Mastic: Pointing Mastic.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and tamp or roll aggregate, sand or tamped earth base.

B. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

C. Prepare surfaces in accordance with manufacturers instructions.

D. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.02 INSTALLATION

A. Installation of Typical Interior Slabs Vapor Barrier:

1. Install vapor barrier in accordance ASTM E1643.

a. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

b. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.

c. The perimeter seal can be handled several ways. When sealing to the slab use Crete Claw. When sealing to a wall use StegoTack Tape or both StegoTack Tape and Stego Term Bar as required.

1) Sealing to Slab: Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
2) Sealing to Wall: Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer’s instructions. Ensure the concrete is clean and dry prior to adhering tape.

d. Overlap joints 6 inches and seal with manufacturer’s seam tape.

e. Apply seam tape/Crete Claw to a clean and dry vapor barrier.

f. Seal all penetrations (including pipes) per manufacturer's instructions.

g. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use Beast Form Stake and Beast Foot as a vapor barrier-safe forming system. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.

h. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.

i. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.

j. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

k. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

B. Installation of Bituminous Vaporproofing/Waterproofing Membrane

1. Apply membrane in accordance with manufacturer's instructions to provide a permanent, monolithic vapor seal without voids or open seams.

2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.

3. Place membrane in position by either Dutch lap method with laps sealed with bonding asphalt or by butt joint method with joints sealed with joint tape.

4. Point exposed edges with pointing mastic to prevent water from traveling under membrane.

5. Place membrane collar around protrusions through concrete slab, including sewer pipes, water pipes, and utility inlets to create a positive seal between protrusions and membrane. Seal in place with joint tape and point around protrusions with pointing mastic.

6. Adhere membrane to vertical surfaces with adhesive.

3.03 PROTECTION

A. Protect all vapor barriers from damage before and during placement of reinforcing and concrete. Check for and repair any puncture before start of concrete placement.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE

SECTION 072713 – SELF-ADHERED NON-PERMEABLE AIR BARRIER MEMBRANE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. General Conditions, Supplementary Conditions, Instructions to Bidders and Division 01 General Requirements shall be read in conjunction with and govern this section.

B. This Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their Work.

1.02 DESCRIPTION

A. Supply labor, materials and equipment to complete the Work as shown on the Drawings and as specified herein to bridge and seal the following air leakage pathways and gaps:

1. Connections of the walls to the roof air barrier.
2. Connections of the walls to the foundations.
3. Seismic and expansion joints.
4. Openings and penetrations of window and door frames, store front, curtain wall.
5. Piping, conduit, duct and similar penetrations.
6. Masonry ties, screws, bolts and similar penetrations.
7. All other air leakage pathways in the building envelope.

B. Materials and installation methods of the primary air/vapor barrier membrane system and accessories.

C. Materials and installation methods of through-wall flashing membranes.

1.03 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete
B. Section 042000 – Unit Masonry
C. Section 054000 – Cold Formed Metal Framing
D. Section 061000 – Rough Carpentry
E. Section 061643 – Exterior Gypsum Sheathing
F. Section 072100 – Building Insulation
G. Section 072113 – Ultra Wall Insulation and Air Barrier System
H. Section 076000 – Flashing and Sheet Metal
I. Section 079200 – Joint Sealants
J. Various Division 07 Roofing Specifications – requirement for coordination sequencing of membrane roofing; requirement to seal roof membrane to wall air barrier.
K. Section 084113 – Aluminum Entrances and Storefronts
L. Section 084413 – Glazed Aluminum Curtain Walls
M. Section 085113 – Aluminum Windows

1.04 REFERENCES

A. The following standards are applicable to this section:

1. ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

2. ASTM E2178: Standard Test Method for Air Permeance of Building Materials.
3. ASTM E283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
4. E1677 Specification for Air Retarder (AR) Material or System for Low-Rise Framed Building Walls.
5. ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
6. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E96: Water Vapor Transmission of Materials.
8. CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced.

1.05 SUBMITTALS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

B. Submit documentation from an approved independent testing laboratory certifying the air leakage and vapor permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the requirements of the Building Code of New York State Energy Code and in accordance with ASTM E2178.

1. Test report submittals shall include test results on porous substrate and include sustained wind load and gust load air leakage results.

C. Submit copies of manufacturers' current ISO certification.

D. Submit manufacturers' current product data sheets for the air barrier membrane system.

1.06 QUALITY ASSURANCE

A. Submit document stating the applicator of the primary air/vapor barrier membranes specified in this section is qualified by the manufacturer as suitable for the execution of the Work.

B. Perform Work in accordance with manufacturer's written instructions and this specification.

C. Maintain one copy of manufacturer's written instructions on site.

D. Allow access to Work site by the air barrier membrane manufacturer's representative.

E. Components used shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, and adhesives.

F. Single-Source Responsibility:

1. Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.

2. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.07 MOCK-UP

A. Construct mock-up in accordance with Section 042000, including all components of the specified wall system.

B. Where directed by architect, construct typical exterior wall panel, 6 foot long by 6 foot wide, incorporating substrate, window frame, attachment of insulation and showing air barrier membrane application details.

C. Mock-up to be reviewed and approved by architect before proceeding with air barrier work. Mock-up may remain as part of the Work.

D. Test mock-up for air and water infiltration to conform with Quality Control, in accordance with ASTM E 783 and ASTM E1105.

1.08 PRE-INSTALLATION CONFERENCE

A. Pre-installation conference shall convene prior to commencing of work of this section.

B. Ensure all contractors responsible for creating a continuous plane of air tightness are present.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to current Product MSDS for proper storage and handling.

B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

C. Store role materials on end in original packaging. Protect rolls from direct sunlight until ready for use.

D. Store air barrier membranes, adhesives and primers at temperatures of 40°F and rising.

E. Keep solvent away from open flame or excessive heat.

F. Wasted Management and Disposal.

1. Separate and recycle all waste materials.

1.10 COORDINATION

A. Ensure continuity of the air seal throughout the scope of this section.

1.11 ALTERNATES

A. The Contractor shall consult the "Bid Proposal Form" and read all alternates and assure himself whether or not they will add to, deduct from, or in any way affect the cost of the work under this section of the specifications. He shall include all such applicable alternates in his proposal.

B. Alternate submission to include:

1. Evidence that alternate materials meet or exceed performance characteristics of Product requirements as well as documentation from an approved independent testing laboratory certifying the air leakage rates and vapor permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the requirements of the Building Code of New York State Energy Code and in accordance with ASTM E2178.

2. Copies of the manufacturer’s current ISO certification.

3. Ten (10) references clearly indicating the membrane manufacturer has successfully completed projects of similar scope and nature for a minimum of ten (10) years.

4. Manufacturer's complete set of details for air barrier membrane system showing a continuous plane of air tightness throughout the building envelope.

1.12 WARRANTY

A. Provide manufacturer's standard 10-year material warranty.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Air/vapor barrier membrane components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.

1. Acceptable Manufacturer:

   Henry Company
   999 N Sepulveda Blvd, Suite 800
   El Segundo, CA 90245
   (800) 598-7663
   www.Henry.com

B. Manufacturer's Standard Products indicated within this section are to establish a level of quality. Equivalency is permitted in accordance with General Municipal Law.

2.02 MEMBRANES (BASIS-OF-DESIGN)

A. Primary sheet air/vapor barrier membrane shall be Blueskin® SA manufactured by Henry; an SBS modified bitumen, self-adhering sheet membrane complete with a blue engineered thermoplastic film. For application temperatures down to 10 degrees F use Blueskin® SA LT. Membrane shall have the following physical properties:

1. ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies,

2. Air leakage: <0.0001 CFM/ft² @1.6 lbs/ft2 to ASTM E2178 and ASTM E283 and have no increased air leakage when subjected to a sustained wind load of 10.5 lbs/ft2 for 1 hour and gust wind load pressure of 62.8 lbs/ft2 for 10 seconds when tested at 1.6 lbs/ft2 to ASTM E331,

3. Vapor permeance: 0.03 perms to ASTM E96 (Desiccant Method),

4. Vapor permeance: 0.08 perms to ASTM E96 (Wet Cup Method),

5. Membrane Thickness: 0.0394 inches (40 mils),

6. Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M,

7. Elongation: 200% to ASTM D412-modifed,

8. Meets CAN/CGSB-51-33 Type I Water Vapor Permeance requirements.

B. Alternate self-adhering membrane for all window and window sill flashings, door openings, inside and outside corners and other transitions shall be HE200 AM Metal Clad manufactured by Henry; a SBS modified bitumen, self-adhering sheet membrane complete with surface layer of metallic

aluminum film that many sealants adhere well to. Membrane shall have the following physical:

1. Peel Adhesion to Primed Steel 15.0 to ASTM D 1000
2. Vapor Permeance: < 0.014 perms to ASTM E 96
3. Membrane Thickness: 0.0443 inches (45 mils)
4. Low temperature flexibility: -15 degrees F to ASTM D146 min
5. Elongation: 40% to ASTM D412-modifed min

C. Liquid-applied flashing alternate to self-adhered flashing membranes for all window, door, MEP penetrations, inside/outside and dissimilar material connections shall be Air-Bloc LF manufactured by Henry; a moisture-curing single component STPe liquid-applied flashing compatible with a variety of substrates and all Henry liquid and self-adhered air barrier membranes. Liquid-flashing shall have the following physical properties:

1. Elongation: minimum 250% minimum to ASTM D412,
2. Tensile Strength: 132% psi minimum to ASTM D412,
3. Nail Sealability: Pass to AAMA 711,
4. VOC Content: 25 g/L max,
5. Solids Content by Volume: 95%,
6. Moisture Absorption: .1% to ASTM D570

D. Through-wall flashing membrane (Self-Adhering) shall be Blueskin® TWF manufactured by Henry; an SBS modified bitumen, self-adhering sheet membrane complete with a yellow engineered thermoplastic film. Membrane shall have the following physical properties:

1. Membrane Thickness: 0.0394 inches (40 mils),
2. Film Thickness: 4.0 mils,
3. Flow (ASTM D5147): Pass @ 212 degrees F,
4. Puncture Resistance: 134 lbf to ASTM E 154,
5. Tensile Strength (film): 5000 psi minimum ASTM D 882,
6. Tear Resistance: 45lbs.-MD, 17lbs.-CD to ASTM D1004,
7. Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M

2.03 PRIMER

A. Primer for self-adhering membranes at temperatures above 25 degrees F shall be Aquatac™ Primer manufactured by Henry; a polymer emulsion based adhesive, quick setting. Primer shall have the following physical properties:

1. Color: Aqua,
2. Weight: 8.7 lbs/gal,

3. Solids by weight: 53%,
4. Water based, no solvent odors,
5. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F

B. Adhesive for self-adhering membranes at all temperatures shall be Blueskin® Adhesive manufactured by Henry, a synthetic rubber based adhesive, quick setting, having the following physical properties:

1. Color: Blue,
2. Weight: 6 lbs/gal,
3. Solids by weight: 35%,
4. Drying time (initial set): 30 minutes

C. Adhesive with low VOC content for self-adhering membranes at all temperatures shall be Blueskin® LVC Adhesive manufactured by Henry, a synthetic rubber based adhesive, quick setting, having the following physical properties:

1. Color: Blue,
2. VOC: <240 g/L,
3. Solids by weight: 40%,
4. Drying time (initial set): 30 minutes

2.04 PENETRATION AND TERMINATION SEALANT

A. Termination Sealant shall be HE925 BES Sealant manufactured by Henry; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:

1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
2. Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
3. Complies with ASTM C 920, Type S, Grade NS, Class 25,
4. Elongation: 450 – 550%,
5. Remains flexible with aging,
6. Seals construction joints up to 1 inch wide

2.05 INSULATION ADHESIVE

A. Insulation adhesive shall be Air-Bloc 21 Insulation Adhesive manufactured by Henry; a synthetic, trowel applied, rubber based adhesive, having the following physical properties:

1. Compatibility: With air barrier membrane, substrate and insulation,
2. Air leakage: 0.0026 CFM/ft^2 @ 2.1 lbs/ft^2 to ASTM E283,
3. Water vapor permeance: 0.03 perms to ASTM E96,
4. Long term flexibility: CGSB 71-GP-24M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.

B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush.

C. Where curing compounds are used they must be clear resin based without oil, wax or pigments.

D. Do not proceed with application of air barrier membrane when rain is expected within 24 hours.

E. Condition materials to room temperature prior to application to facilitate handling.

3.02 SURFACE PREPARATION

A. Surfaces must be sound, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane.

B. New concrete should be cured for a minimum of 14 days and must be dry before air/vapor barrier membranes are applied.

C. Ensure all preparatory Work is complete prior to applying primary air/vapor barrier membrane.

D. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.

E. Apply primer at rate recommended by manufacturer to all areas to receive self-adhering sheet air/vapor barrier membrane and or through-wall flashing membrane as indicated on drawings by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by self-adhering membrane or self-adhering through-wall flashing membrane during the same working day must be re-primed.

3.03 INSTALLTION OF AIR BARRIER SYSTEM

A. INSIDE AND OUTSIDE CORNERS

1. Seal inside and outside corners of sheathing boards with a strip of self-adhering air/vapor barrier membrane extending a minimum of 3 inches on either side of the corner detail.

    a. Prime surfaces as per manufacturers' instructions and allow to dry.

    b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.

    c. Roll all laps and membrane with a counter top roller to ensure seal.

B. TRANSITION AREAS

1. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhering air/vapor barrier membrane.

    a. Prime surfaces as per manufacturers' instructions and allow to dry.

    b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Provide minimum 3 inch lap to all substrates.

    c. Ensure minimum 2 inch overlap at all end and side laps of membrane.

    d. Roll all laps and membrane with a counter top roller to ensure seal.

C. WINDOWS AND ROUGH OPENINGS

1. Wrap rough openings with self-adhered air/vapor barrier membrane as detailed.

    a. Prime surfaces as per manufacturers' instructions and allow to dry.

    b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.

    c. Roll all laps and membrane with a counter top roller to ensure seal.

D. LIQUID-APPLIED FLASHING OPTION – (when approved by the Architect)

1. Use for door and window openings, MEP penetrations and dissimilar material connections.

    a. Apply liquid flashing to all material joints and tool smooth.

    b. Apply liquid flashing in a serpentine fashion to the entire window opening and tool smooth to a minimum 25 mils wet film thickness. Spread material to cover the inside of rough openings and extend 4 inches onto adjacent surfaces. Create a slight positive slope towards the exterior of sill conditions by applying more material to the interior side of sills to create a taper towards the exterior while maintaining a minimum 25 mils wet film thickness.

    c. Apply liquid flashing to MEP penetrations with a maximum of ½ inch annular space. Extend liquid flashing a minimum 4 inches onto penetrating item and surrounding surfaces to a minimum of 25 mils dry film thickness.

    d. Apply liquid flashing to inside/outside corners and dissimilar material connections. Extend a minimum 4 inches onto adjacent surfaces a minimum of 4 inches and a minimum wet film thickness of 25 mils dry film thickness.

    e. Apply fluid-applied membrane air barrier onto liquid flashing a minimum of 2 inches.

E. THROUGH-WALL FLASHING MEMBRANE

1. Apply through-wall flashing membrane along the base of masonry veneer walls and over shelf angles as detailed.

    a. Prime surfaces and allow to dry, press membrane firmly into place, over lap minimum 2 inches at all end and side laps. Promptly roll all laps and membrane to ensure the seal.

    b. Applications shall form a continuous flashing membrane and shall extend up a minimum of 8 inches up the back-up wall.

    c. Seal the top edge of the membrane where it meets the substrate using termination sealant. Trowel-apply a feathered edge to seal termination to shed water.

    d. Install through-wall flashing membrane and extend 1/2 inch from outside edge of veneer. Provide end dam flashing as detailed.

F. PRIMARY AIR BARRIER

1. Apply self-adhering air/vapor barrier membrane complete and continuous to prepared and primed substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.

    a. Prime surfaces as per manufacturers' instructions and allow to dry.

b. Align and position self-adhering air/vapor barrier membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.

c. Roll all laps and membrane with a counter top roller to ensure seal.

d. At the end of each days work seal the top edge of the membrane where it meets the substrate with termination sealant. Trowel apply a feathered edge to seal termination and shed water.

3.04 FIELD QUALITY CONTROL

A. Make notification when sections of Work are complete to allow review prior to covering air/vapor barrier system.

3.05 INSTALLATION OF INSULATION

A. Coordinate with Ultra Wall Insulation and Air Barrier System Section 072113 for insulating materials.

B. Apply insulation adhesive in a serpentine pattern over the air barrier membrane.

1. Dab Method: Apply walnut-sized dabs of insulation adhesive spaced 6 inches on center to substrate. Apply insulation using sufficient hand pressure to compress dabs up to 2 inches in diameter.

2. Bead Method: Apply ¼ inch beads 6 inches on center in a serpentine pattern.

C. Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.

3.06 PROTECTION

A. Damp substrates must not be inhibited from drying out. Do not expose the backside of the substrate to moisture or rain.

B. Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane.

C. Air/vapor barrier membrane is not designed for permanent exposure. Good practice calls for covering as soon as possible.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 073113.10 – ASPHALT SHINGLES (Landmark Premium)

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish and install new granule surfaced asphalt roofing shingles, moisture shedding underlayment, eaves, valley & ridge protection and associated metal flashing as indicated on the drawings and specified herein.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Related section include the following:

1. Section 061000 – Rough Carpentry
2. Section 072100 – Building Insulation
3. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
4. Section 074293 – Metal Fascia & Soffit Panels
5. Section 076000 – Flashing and Sheet Metal
6. Section 076219 – Fabricated Gravel Stops and Fascia
7. Section 077000 – Roof Specialties and Accessories
8. Section 079200 – Caulking & Sealants
9. Section 099000 – Painting & Staining

1.03 REFERENCES

A. ASTM A 653/A 653M – Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron-Alloy-Coated (Galvannealed) by the Hot-Dip Process
B. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C. ASTM B 370 – Standard Specification for Copper Sheet and Strip for Building Construction
D. ASTM D 225 – Standard Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules
E. ASTM D 226 – Standard Specification for Asphalt-Saturated Organic Felt used in Roofing and Waterproofing
F. ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials used as Steep Roofing Underlayment for Ice Dam Protection
G. ASTM D 3018 – Standard Specification for Class A Shingles Surfaced with Mineral Granules
H. ASTM D 3161 – Standard Test Method for Wind Resistance of Asphalt Shingles (Fan-Induced Method)
I. ASTM D 3462 – Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules
J. ASTM D 4586 – Standard Specification for Asphalt Roof Cement, Asbestos-Free
K. ASTM D 4869 – Standard Specification for Asphalt-Saturated Organic Felt Shingle Underlayment used in Roofing
L. ASTM D 6757 – Standard Specification for Inorganic Underlayment for use with Steep Slope Roofing Products
M. ASTM D7158 – Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)
N. ASTM E 108 – Standard Test Methods for Fire Test of Roof Coverings

O. ASTM G 21 – Determining Resistance of Synthetic Polymers to Fungi

1.04 SUBMITTALS

A. Submittals shall be in accordance with section 013300 – Submittal Procedures and as follows:

1. Product Data: Provide manufacturer's printed product information indicating material characteristics, performance criteria and product limitations.

2. Manufacturer's Installation Instructions: Provide published instructions that indicate preparation required and installation procedures.

3. Certificate of Compliance: Provide Certificate of Compliance from an independent laboratory indicating that the asphalt fiberglass shingles made in normal production meet or exceed the requirements of the following:

   a. ASTM E 108/UL 790 Class A Fire Resistance
   b. ASTM D 3161/UL 997 Wind Resistance
   c. ASTM D 3462

4. Shop Drawings: Indicate specially configured metal flashing, jointing methods and locations, fastening methods and locations and installation details as required by project conditions indicated.

5. Samples: Submit two 4" x 6" samples showing color, texture, and thickness of the material.

6. Roofer certification: Submit evidence of "Select Shingle Master" credentials.

1.05 QUALITY ASSURANCE

A. Installer Minimum Qualifications: Installer shall be licensed or otherwise authorized by all federal, state and local authorities to install all products specified in this section. Installer shall perform work in accordance with NRCA Roofing and Waterproofing Manual. Work shall be acceptable to the asphalt shingle manufacturer.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by architect.
2. Do not proceed with remaining work until workmanship, color and pattern are approved by Architect.
3. Rework Mock-Up area as required to produce acceptable work.

C. Pre-Installation Meeting – Conduct a pre-installation meeting at the site prior to commencing work of this section: Require attendance of entities directly concerned with roof installation. Agenda will include:

1. Installation methods and manufacturer's requirements and recommendations.
2. Safety procedures.
3. Coordination with installation of other work.
4. Availability of roofing materials.
5. Extra Material – Furnish under provision of section 017000.
6. Provide 100 square feet of extra shingles of each color specified.
7. Preparation and approval of substrate and penetrations through roof.
8. Other items related to successful execution of work.
9. Product Compliance – Verify that products conform with all requirements specified by local

Authority Having Jurisdiction (AHJ).

D. Maintain one copy of manufacturer's application instructions on the project site.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store Products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials and materials used with solvent based materials in accordance with requirements of Authorities Having Jurisdiction.

C. Deliver shingles to site in manufacturer's unopened labeled bundles. Promptly verify quantities and conditions. Immediately remove damaged products from site.

D. Store materials on raised platforms and protect with coverings at outdoor locations. Use of wet materials will not be permitted.

E. Do not stack bundles of shingles more than 4 feet high.

F. Store rolled goods on end.

1.07 PROJECT ENVIRONMENTAL CONDITIONS

A. Anticipate and observe environmental conditions (temperature, humidity and moisture) within limits recommended by manufacturer for optimum results. Do not install products under environment conditions outside manufacturer's limits.

B. Take special care when applying WinterGuard Waterproofing Shingle Underlayment and shingles when ambient or wind chill temperature is below 45 degrees F. Tack WinterGuard in place if it does not adhere immediately to the deck.

1.08 WARRANTY

A. Manufacturer's Warranty: Furnish shingle manufacturer's warranty for the product listed below:

1. CertainTeed **Landmark Premium**: Lifetime limited warranty.

B. Warranty Supplement: Provide manufacturer's supplemental warranty (CertainTeed's SureStart or SureStart PLUS) to cover labor and materials in the event of a material defect for the following period after completion of application of shingles:

1. First Ten Years (**Landmark Premium** Shingles)
2. No SureStart or SureStart PLUS for any shingle applied to inadequately ventilated roof deck.

C. Extended Warranty Protection (can only be provided by a CertainTeed Credentialed Contractor): Provides NON PRO-RATED SureStart Plus protections and 130 mph wind warranty as follows: **Landmark Premium** shingles carry:

1. 5-Star Coverage (50 years) material and labor costs for repair or replacement, tear off and disposal costs, and workmanship defects.

D. Refer to manufacturer's warranty for adjustments for commercial applications.

E. Provide Upgraded Wind Warranty 130 mph for first 15 years by complying with all manufacturers' conditions and instructions (see section 2.2-B below).

PART 2 - PRODUCTS

2.01 GENERAL

A. Design is based on use of asphalt/fiberglass shingles as manufactured by the CertainTeed Corporation. Contact Sales Support Group, P.O. Box 860, Valley Forge, PA 19482, Toll Free 800-233-8990, and the terminology used may include reference to that manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

B. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

C. Shingle color shall be as shown on the drawings or as selected by the Architect.

2.02 MATERIALS

A. Asphalt Fiberglass Shingles: CertainTeed **Landmark Premium**: Conforming to ASTM D 3018 Type I – Self-Sealing, UL Certification of ASTM D 3462, ASTM D 3161/UL997 130-mph Wind Resistance and UL Class A Fire Resistance, glass fiber mat base, ceramically colored/UV resistant mineral surface granules across entire face of shingle; two-piece laminated shingle; algae-resistant.

B. Wind warranty upgrade – These products are warranted to resist blow-off due to wind velocities, including gusts, up to a maximum of 130 miles per hour during the first fifteen (15) years, provided all of the following conditions are met:

1. CertainTeed shingles are not applied over existing roof shingles (roof-overs are not permitted).
2. CertainTeed specified corresponding hip and ridge accessory products are installed as cap shingles (Shadow Ridge™, Cedar Crest™, Mountain Ridge™ (& IR).
3. CertainTeed specified corresponding starter shingles are installed along the roof eaves and rakes (Swiftstart™ and High-Performance Starter).

C. Weight: 300 pounds per square (100 square feet).

D. Sheathing: Sheathing shall be American Plywood Association rated with a minimum thickness of 15/32", or as indicated on the drawings. Refer to Specification Section 061000.

E. Eaves Protection: CertainTeed “WinterGuard”; ASTM D1970 sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement and “split” back plastic release film; provide material warranty equal in duration to that of shingles being applied.

1. CertainTeed WinterGuard Sand

F. Underlayment: CertainTeed “Roofers’ Select”, ASTM D 6757; asphalt-impregnated fiberglass-reinforced organic felt designed for use on roof decks as a water-resistant layer beneath roofing shingles.

G. Waterproofing Underlayment: CertainTeed “WinterGuard”; ASTM D 1970 sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and “split” back plastic release film; Use in “low slope’ areas (below 4:12, but no less than 2:12 pitch); provide material warranty with equal in duration to that of shingles being applied.

1. CertainTeed WinterGuard Sand

H. Flashing: Corrosion-resistant metal as indicated on the drawings or as follows:

1. Sheet Flashing: ASTM B 370; cold rolled copper; 16 ounces per square foot, natural finish.

I. Nails: Standard round wire type roofing nails, corrosion resistant; hot dipped zinc coated steel, aluminum or chromated steel; minimum 3.8 inch head diameter; minimum 11 or 12 gage shank diameter; shank to be sufficient length to penetrate through the roof sheathing or ¾ inch into solid wood, plywood or non-veneer wood decking, but not less than 1-1/2" long. Staples are specifically disallowed.

J. Asphalt Roofing Cement: ASTM D 4586, Type I or II.

2.03 FLASHING FABRICATION

A. Form flashing to profiles indicated on Drawings and to protect roofing materials from physical damage and shed water.

B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

2.04 ATTIC VENTILATION

A. CertainTeed Ridge Vent (4 lf.) Filtered 12 in. width.

1. Shingle over ridge vent designed with an external baffle to deflect wind and weather over the vent. The external baffle creates low pressure over the vent openings to "pull" air from the attic.

2. Internal weather filter helps protect the attic from wind driven rain, snow, dust and insects.

3. 12" vent provides 18 sq inches of net free area per linear foot; 9" vent provides 16 sq inches of net free area per linear foot.

4. CertainTeed Ridge Vent is pre-formed to a 4/12 pitch, and fits pitches from 3/12 to 16/12.

5. Limited Lifetime Warranty and 5-Year SureStart™ Protection.

B. CertainTeed Intake Vent (4 lf).

1. Designed for homes with little or no intake ventilation in the soffit area.
2. Each vent has 9 sq inches of net free area per linear foot.
3. Minimum 3/12 roof pitch with no maximum.
4. Lifetime Limited Warranty; 5-Year SureStart™ Protection.

PART 3 - EXECUTION

3.01 GENERAL

A. Installation of all roofing underlayment and shingles shall be in accordance with manufacturer's published procedures/instructions/ requirements.

B. Under no circumstances shall any stage of the roofing operations be performed during rain or snow, or when the deck material being covered is wet or covered with frost or snow.

C. Installation of roofing shall not begin until underlying surfaces are smooth, firm, dry, free from dirt, foreign material, high spots and depressions, and have been inspected and approved by the roofer.

D. The installer shall examine roof decks before the trade responsible for the decks leaves the job. The installer shall then obtain and deliver to the Architect written approval of the condition of the deck to receive roofing materials.

3.02 EXAMINATION

A. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surfaces.

B. Verify deck surfaces are dry and free of ridges, warps or voids.

3.03 ROOF DECK PREPARATION

A. Follow shingle manufacturer's recommendations for acceptable roof deck material.

B. Broom clean deck surfaces under eave protection and underlayment prior to their application.

3.04 INSTALLATION – GENERAL

A. Plumbing vents and other projections through roof surfaces shall be properly positioned and secured.

B. Ventilation must be provided via a vented attic with intake vents or soffit vents and continuous ridge ventilation as indicated on the Construction Drawings.

1. For non-vented attic situations, the attic must be "sealed" from the roofing by means of continuous insulated non-vented nailboard.

C. Copper step flashing must be installed at all slope transitions to upper wall areas. Coordinate installation with siding or other cladding work, if applicable.

D. Install one layer of underlayment over the entire roof area.

E. At rakes and eaves, install 36" wide self-adhering waterproofing underlayment. Install 10 oz. copper drip edges over the underlayment at the rakes, and beneath the underlayment at the eaves.

1. In areas requiring 130 mph wind resistance, provide rake and eave starters so as to obtain the 130 mph wind resistance warranty.

F. At valleys, install 36" wide self-adhering waterproofing underlayment for full length. Install shingles per Closed-Cut method, unless indicated otherwise on the Construction Drawings.

G. Install shingles according to 6" Stepped-Off Diagonal Method found on each bundle of shingles. Weather exposure is 5". Leave 1-1/2" projection over rakes and eaves.

1. Install 4 fasteners per shingle. On slopes greater than 21" per foot, install an additional fastener and apply a spot of roofing cement under each shingle tab corner.

H. At hips and ridges use Shadow Ridge accessory shingles of matching color.

3.05 INSTALLATION – EAVE ICE DAM PROTECTION

A. Place eave edge and gable metal edge flashing tight with fascia boards. Weather-lap joints 2 inches. Secure flange with nails spaced 8 inches on center.

B. Apply CertainTeed "WinterGuard" Waterproofing Shingle Underlayment as eave protection in accordance with manufacturer's instructions.

C. Extend eave protection membrane minimum 24 inches up slope beyond interior face of exterior wall. Extend eave protection to 48 inches or greater for low slope roofs or severe climatic conditions.

3.06 INSTALLATION – PROTECTIVE UNDERLAYMENT

A. Roof Slopes between 2:12 and 4:12: Apply two layers of Roofer's Select or D4869 underlayment over areas not protected my WinterGuard at eaves, with ends and edges weather-lapped 19 inches. Stagger end laps each consecutive layer. Nail in place.

B. Roof Slopes 4:12 or Greater: Install one layer of asphalt felt shingle underlayment perpendicular to slope of roof and lap minimum 4 inches over eave protection.

C. Weather-lap and seal watertight with asphalt roofing cement items projecting through or mounted on roof. Avoid contact or solvent-based cements with WinterGuard.

3.07 INSTALLATION – VALLEY PROTECTION

A. For "closed-cut," "woven," and "open" valleys, first place one ply of WinterGuard, minimum 36 inches wide, centered over valleys. Lap joints minimum of 6 inches. Follow instructions of shingle and waterproofing membrane manufacturer.

3.08 INSTALLATION – METAL FLASHING

A. Weather-lap joints minimum 2 inches.

B. Seal work projecting through or mounted on roof with asphalt roofing cement and make weather tight.

3.09 INSTALLATION – ASPHALT SHINGLES

A. Install shingles in accordance with manufacturer's instructions for product type and application specified.

3.10 FIELD QUALITY CONTROL

A. Visual inspection of the work will be performed by the Architect. If conditions are unacceptable work shall be corrected as directed by the Architect.

3.11 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished roof surface.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 074213.23 – METAL COMPOSITE MATERIAL WALL PANELS (ALUCOBOND)

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. The General Conditions accompanying these specifications shall apply to and bind all Contractors for the work.

1.02 RELATED SECTIONS

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Related Sections include the following:

1. Section 042000 – Unit Masonry
2. Section 055000 – Metal Fabrications
3. Section 061000 – Rough Carpentry
4. Section 061643 – Gypsum Sheathing
5. Section 072100 – Building Insulation
6. Section 072113 – Ultra Wall Insulation and Air Barrier System
7. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
8. Section 076000 – Flashing and Sheet Metal
9. Section 079200 – Joint Sealants
10. Various Division 08 Sections - exterior doors and frames, windows and louvers.

1.03 SCOPE

A. The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, appliances, and materials and performing all operations in connection with the installation of all aluminum-faced composite panel systems complete, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

B. Panel system requirements include the following components:

1. Aluminum faced composite panels with mounting system. Panel mounting system including anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete installation.

2. Parapet coping, column covers, soffits, sills, border, and filler items indicated as integral components of the panel system or as designed.

3. Interior panel system work that basically matches exterior panel system work.

C. All engineering, manufacturing and installation of the items listed by a single manufacturer and wall systems contractor trained, tested and certified by the manufacturer for proficiency in erecting the specified products.

1. Furnish and install all aluminum faced composite panels with integral reveals and profiled panels with compatible joinery and associated accessories to form a weathertight installation where shown on drawings. All panels shall be designed to permit installation in either vertical

or horizontal orientations.

2. Furnish and install all required extruded aluminum trim related to the wall and window system and its intersection with adjacent materials.

3. Furnish and install all required sealants and gasketing between panels, windows and their intersections.

4. Furnish and install adjustable secondary supports for the panel and window system specified.

1.04 APPLICABLE REFERENCES

A. The following Aluminum Association bulletins form a part of this specification:

1. AA-M12C22A41: Anodized - Clear Coating
2. AA-M12C22A44: Anodized - Color Coating

B. The following ASTM publications form a part of this specification:

1. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.
2. ASTM E283 - Rate of Leakage through Exterior Windows, Curtain Walls, and Doors.
3. ASTM D1781 – Climbing Drum Peel Test for Adhesives.
4. ASTM E84 – Surface Burning Characteristics of Building Materials.
5. ASTM E162 – Surface Flammability of Materials Using a Radiant Heat Energy Source.
6. ASTM D3363 – Method for Film Hardness by Pencil Test.
7. ASTM D2794 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
8. ASTM D3359 – Methods for Measuring Adhesion by Tape Test.
9. ASTM D2247 – Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
10. ASTM B117 – Method of Slat Spray (Fog) Testing.
11. ASTM D2244 – Calculation of Color Differences from Instrumentally Measured Color Coordinates.
12. ASTM D4214 – Evaluating the Degree of Chalking of Exterior Paint Films.
13. ASTM D822 – Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer and Related Products.
14. ASTM D1308 – Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

C. The following International Conference of Building Officials (ICBO) publications form a part of this specification:

1. UBS 17-5 – Room Fire Test Standard for Interior of Foam Plastic Systems

1.05 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Submit all manufacturer's technical product data, installation instructions, and recommendations for each material required. Include data substantiating that materials comply with specified requirements.

C. Shop Drawings: Detailed shop drawings must be submitted for approval prior to fabrication. Shop drawings shall show the project layout and elevations, fastening and anchoring methods, detail and location of all joints, sealants and gasketing, including joints necessary to accommodate thermal movement; trim; flashing and accessories. Details are to be provided showing a structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel

system as determined by ASTM E 331. Shop and erection drawings shall clearly illustrate the details required to comply with the performance requirements specified including interface of the panel system with adjoining construction. All materials and finish for each component shall be clearly defined. Erection procedures shall be included where required to clearly explain proper installation of fasteners, trim, gaskets and sealants. Calculations supporting structural performance shall be prepared by a Professional Engineer in the state of New York. Samples shall be submitted to illustrate the panel design, texture, color and other features specified. Systems not utilizing a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated System) shall provide a means of concealed drainage with baffles and weeps for water which may accumulate in members of the system. Along with shop drawings, provide an original affadavit from the manufacturer, certifying that the material meets the requirements specified.

D. Documents showing product compliance with the national and local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product. Submit test reports and certifications to demonstrate compliance with performance requirements and building code acceptance specified.

E. Maximum deviation from vertical and horizontal alignment of erected panels: ¼" (6mm) in 20' (6m) non-accumulative.

F. Panel fabricator/installer shall assume undivided responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

G. Composite panel manufacturer shall have established a Certification Program acceptable to the local Code Authorities.

H. Samples: Provide:

1. Panel System Assembly: Two (2) samples of each type of assembly. (12" x 12" minimum).
2. Two (2) samples of each color and/or finish selected. (3" x 4", minimum).

1.06 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Both manufacturer and system installer shall demonstrate a minimum of ten (10) years of experience in the successful completion of projects employing similar materials, applications and performance requirements. The Manufacturer shall supply to the Architect the name, address, contact name and phone number of subcontractor(s) he intends to utilize for this project. Contractor shall submit in writing certifications from his installing subcontractors that they have completed all required training seminars, and are fully qualified to bid and execute the work of this Section.

B. The manufacturer and composite panel systems installation subcontractors shall provide to the Architect a list of five (5) similar completed projects with addresses of the completed projects with addresses of the locations, architect and owner.

1. Composite Panel Manufacturer shall be solely responsible for panel manufacture and application of the finish.

2. Fabricator/installer shall be acceptable to the composite panel manufacturer. Contact the Customer Relations Department at 3A Composites USA, Inc. (800-626-3365 / 270-527-4200) for information on the Distributor Network in a specific geographic region.

3. Field measurements should be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by

the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.

1.07 SUBSTITUTIONS

A. Materials, accessories and testing specified shall establish the minimum level of quality, performance, dimension and appearance required of any substitution.

B. No substitution will be considered unless a written request to the Architect is received for approval at least ten (10) days prior to the established bid date. Evidence shall be submitted to demonstrate equivalency to the products and performance levels specified.

C. Provide:

1. A complete description of the substitution, including details referenced to the wall and window conditions shown on the contract drawings.

2. Independent test reports verifying compliance with specified performance requirements.

3. A detailed listing of each specification item with which the substitution does not fully comply.

D. The manufacturer or wall systems subcontractor proposing the substitution shall pay the costs of any other Prime Contractors or subcontractors affected by the proposed substitution.

1.08 DELIVERY, STORAGE AND HANDLING

A. Protect all finishes and edges in accordance with the panel manufacturer's recommendations.

B. Store all materials in accordance with the panel manufacturer's recommendations.

1.09 PERFORMANCE REQUIREMENTS

A. Panels and secondary supports shall be designed for component and cladding wind loads determined in accordance with the more stringent of the local building code or ASCE 7-98.

B. Secondary supports for the panel system shall be designed in accordance with AISC or Aluminum Association design parameters. Through-tube support systems shall be designed and installed only by the manufacturer and certified wall systems contractor.

C. Secondary supports shall not vary from the theoretical plane by more than the specified tolerances. (Note: These tolerances are more stringent than AISC or ACI tolerances, to ensure optimal appearance and performance of the wall system.)

1. ¼ inch in any 20-foot length, vertically or horizontally.

2. + or – ½ inch maximum, in any building elevation.

3. + or – 1/8 inch within 5 feet of any change in plane, such as corners and soffits.

D. Cold-formed steel girts, subgirts, or studs which insulated metal panels are attached shall be a minimum of 16 gauge (SSMA 54 mils). Cold formed steel 18 gauge (SSMA 43 mils or lighter shall not be used as structural supports. All cold-formed framing shall be designed in accordance with the latest edition of AISI or North American Standard Specification. Double studs or minimum 3" wide bearing surface shall be provided at all vertical joints of horizontal panel systems and at all horizontal stack joints of vertical panel systems to insure the integrity of liner side seals.

E. The panel system and secondary supports shall be designed to allow differential movement of the building's roof and floor structures. (Note: Movement of roof and/or floor systems exceeding ¼" shall require the use of thru-tube supports with sliding connections.

F. Performance of the wall panel system shall be verifiable with tests witnessed or conducted by independent agencies.

G. Structural performance of the wall panels shall be derived from ASTM E72 Chamber Method with a deflection limit of 1/180 applied to positive load. Ultimate structural values shall be achieved without the use of backside mechanical attachments to the structure.

H. Thermal performance of the wall panels shall be based on tests in accordance with ASTM C1353 corrected to 15 mph outside and still air inside. Tests shall include 3 side-joints, in a mock-up assembly approx. 5'-0" x 5'-0" in size, standard fastening and integral reveals or profiling. Where reveals exceed the standards the manufacturer shall provide similar testing to document any adjustments required to the standard conditions.

1. R value for 2" flat panel shall be 14.5.
2. R value for 3" flat panels shall be 18.9.
3. R value for 2" profiled panels shall be 12.8

(Refer to contract drawings for thickness of wall panels)

I. Air infiltration of the wall panels shall not exceed .06 cfm/ft^2 at a static pressure of 6.24 psf (equivalent to 49 mph wind) when tested in accordance with ASTM E283. Mock-up test size should be approximately 10'-0" x 10'-0" in size to simulate actual field conditions.

J. There shall be no uncontrolled water penetration through the panel joints at 12 psf (equivalent to 68.5 mph wind) when tested in accordance with ASTM E331. Mock-up test size should be approximately 10'-0" x 10'-0" in size to simulate actual field conditions.

K. The standard horizontal panel joint shall demonstrate effective rain screen and pressure equalization principles with interior seal broken at least 1" in 10 linear feet of panel and any exterior seal removed when tested at a static pressure of 12 psf (equivalent of 68.5 mph wind) in accordance with ASTM E331. Effective performance shall mean no water rising within the equalization chamber and no uncontrolled leakage to the interior.

1.10 BUILDING CODE ACCEPTANCE

A. Wall panel system shall comply with requirements for foam plastics and finished panel performance as established by the applicable building code for use where non-load bearing, non-combustible wall construction is permitted. Laboratory and full-scale testing including, but not limited to the following shall be available. (Note: Tests of building units shall be conducted with the joinery, sealant, clips and fastening intended for the project.)

1. Foam core and interior surface of the complete panel system shall demonstrate compliance with the following criteria for surface burning characteristics per UL Standard 723 (ASTM E84):

   Flame Spread – 25* or less.
   Smoke Developed – 450 or less.

   Numerical flame spread ratings are not intended to reflect hazards presented by these materials under actual fire conditions.

2. Classified as Building Units for Interior Building Construction per UL Standard 1715.

3. Classified as a component of fire rated non-load bearing wall assemblies per UL Standard 263.

4. Approved per FM Standard 4880 as a Class I insulated wall and/or ceiling panel.

5. Evaluated per UBC 26-9 Intermediate Scale Fire Test for flammability characteristics of exterior non-load bearing wall panel assemblies.

6. Ignition temperature of the foam plastic core shall have been established per ASTM D1929.

7. Panels shall be approved for use without the requirement of a thermal barrier or automatic sprinkler.

1.11 WARRANTY

A. The manufacturer shall warrant for a period of one (1) year that the panel and window system frame materials will be free from defects. The wall systems contractor shall warrant for a period of one year that the installation workmanship will be free from defects.

B. Painted finish warranties shall be the paint manufacturer's standard for wall panels and finished extrusions.

PART 2 - MATERIALS

2.01 GENERAL

A. As Basis-of-Design, details and specifications have been based on the following products by 3A Composites USA, Inc. 208 West 5th Street, Benton, KY 42025 (800-626-3365 / 270-527-4200):

1. Alucobond Plus Panels. Thickness: **4mm (0.157")** as indicated on the contract drawings.

B. References to named manufacturers shall be construed only as establishing the quality of materials and workmanship to be used under this section, as shall not, in any way, be construed as limiting competition. Products used shall be those upon which the design is based, or shall be equal products approved in advance by the Architect. Requests for substitutions will be considered in accordance with provisions of the General Conditions. All permitted equals must be approved in writing by the Architect or Engineer-of-Record. All applications for substitution must include samples and technical data. Items of the same function and performance, which have received prior approval from the architect, shall be allowed for this project. Approval shall be based on documentation submitted showing the adequacy of the material.

C. Materials shall conform to the following product performance requirements:

1. Bond Integrity: When tested for bond integrity, in accordance with ASTM D 1781 (simulating resistance to panel delamination), there shall be no adhesive failure of the bond a) between the core and the skin nor b) cohesive failure of the core itself below the following values:

Peel Strength:	100 N·mm/mm (22.5 in·lb/in) as manufactured. 100 N·mm/mm (22.5 in·lb/in) after 8 hours in water at 200°F. 100 N·mm/mm (22.5 in·lb/in) after 21 days soaking in water at 70°F.
Fire Performance:	ASTM E 84 - Flame Spread 0, Smoke Developed 0 ASTM E 162 - No surface flaming UBC 17-5 - No flame spread along interior face or penetration through the wall assembly.

2. Finishes: Coil coated KYNAR® 500 or HYLAR® 5000 based Polyvinylidene Fluoride (PVDF) or Fluoro Ethylene – Alkyl Vinyl Ether (FEVE) resin in conformance with the following general requirements of AAMA 2605. Standard color PVDF and FEVE coil coatings offer a ten (10) year coating warranty. Warranty for custom colors shall be reviewed on an individual basis.

3. Color: As selected by the Architect from the manufacturer's full range of colors or a custom color to be matched by the panel supplier.

4. Coating Thickness: 3 coat finish – 1.5 mil (+/- 0.15 mil), 38.1 mm (+/- 3.8 mm).

5. Hardness: ASTM D3363; F minimum, using Eagle Turquoise Pencil.

6. Impact Test Method: ASTM D2794 – Gardner Variable Impact Tester with 5/8" (15.9 mm) mandrel.

7. Coating shall withstand reverse impact of 1.5 in.lb. per mil substrate thickness (0.681 m.kg per mm substrate).

8. Coating shall adhere tightly to metal when subjected to #600 Scotch Tape pick-off test. Slight minute cracking permissible. No removal of film to substrate.

9. Adhesion Test Method: ASTM D3359. Coating shall not pick off when subjected to a grid of 11 cuts x 11 cuts, 1/16" apart, and taped with # 600 Scotch Tape.

10. Humidity Resistance Test Method: ASTM D2247. No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100°F (37.8°C) for 4000 hours.

11. Salt Spray Resistance Test Method: ASTM B117 – Expose coating system to 4,000 hours, using 5% NaCl solution.

12. Corrosion creepage from scribe line: 1/16" max. (1.6mm). Minimum blister rating of 8 within the test specimen field.

13. Weather Exposure - Outdoor:

    Ten-year exposure at 45° angle facing south Florida exposure.

    Maximum color change of 5 Delta E units as calculated in accordance with ASTM D 2244.

    Maximum chalk rating of 8 in accordance with ASTM D 4214.

    No checking, crazing, adhesion loss.

14. Chemical Resistance:

    ASTM D 1308 utilizing 10% Muriatic Acid for an exposure time of 15 minutes. No loss of film adhesion or visual change when viewed by the unaided eye.

    ASTM D 1308 utilizing 20% Sulfuric Acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by the unaided eye.

    AAMA 2605 utilizing 70% reagent grade Nitric Acid vapor for an exposure time of 30 minutes. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D 2244.

    Clear Coating: AA-M12C22A41, Architectural Class I

Color Coating: AA-M12C22A44, light bronze, medium bronze, dark bronze and black, Architectural Class I

Urethane Coating:

For small quantity aluminum accent panels or custom color applications, provide a multi coat urethane finish in accordance with the paint manufacturer's requirements.

2.02 PANEL FABRICATION

A. Composition: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

B. Aluminum Face Sheets:

1. Thickness: 0.5mm (0.019") nominal

2. Alloy: AA3000 Series (Painted material) AA5000 Series (Anodized material)

3. Panel Weight: 4mm (0.157"): 5.47 kg/m² (1.12 lb/ft²)

4. Tolerances:

a. Panel Bow: Maximum 0.8% of any 1828mm (72”) panel dimension.

b. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.

c. Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

d. Maximum deviation from panel flatness shall be 1/8" (3.2mm) in 5'0" (1.52m) on panel in any direction for assembled units. (Non-accumulative - No Oil Canning)

5. System Characteristics:

a. Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards.

b. System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

c. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" by AAMA and ANSI/AAMA 302.9 requirements for aluminum windows.

d. Fabricate panel system to dimension, size, and profile indicated on the drawings based on a design temperature of 70°F (21°C).

e. Fabricate panel system so that no restraints can be placed on the panel, which might result

in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.

f. The finish side of the panel shall have a removable plastic masking applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

g. System Type: System shall be as indicated on the drawings, one of the following:

1) Rout and Return Wet: System must provide a wet seal (caulked) reveal joint as detailed on drawings. The sealant type shall be as specified in Section 079200 and with foamed type backer rod as indicated on architectural drawings.

2) Rout and Return Dry: System must provide a perimeter aluminum extrusion with integral weather-stripping as detailed on drawings. No field sealant required in joints unless specifically noted on drawings.

3) Rear Ventilated Rain Screen: System must provide a reveal joint as detailed on drawings. Provide moisture barrier and sheathing as shown on drawings.

h. System Performance: Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the Architect and/or the local building code.

i. Wind Load:

1) If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

2) Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 20 lb/ft² (959 N/m²) and 30 lb/ft² (1438 N/m²) on parapet and corner panels. Wind load testing shall be conducted in accordance with ASTM E 330 to obtain the following results.

3) Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed L/175 or 3/4" (19mm), whichever is less.

4) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/60 of the full span.

5) Maximum anchor deflection shall not exceed 1/16" (1.6mm).

6) At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16" (1.6mm).

j. Air/Water System Test:

1) If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

2) Air Infiltration - When tested in accordance with ASTM E 283, air infiltration at 1.57 lb/ft² (75 Pa) must not exceed 0.06 ft^3/min. per ft² of wall area (305 cm^3/s per m^2 of wall

area).

3) Water Infiltration - Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems not using a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated Systems) shall be designed to drain any water leakage occurring at the joints. No water infiltration shall occur in any system under a differential static pressure of 6.24 lb/ft² (300 Pa) after 15 minutes of exposure in accordance with ASTM E 331.

2.03 ACCESSORIES

A. Extrusions, formed members, sheet, and plate shall conform with ASTM B 209 and the recommendations of the manufacturer.

B. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.

C. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.

D. Fabricate flashing materials from 0.030" (0.76mm) minimum thickness aluminum sheet painted to match the adjacent curtain wall / panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.

E. Fasteners (concealed/exposed/non-corrosive): Fasteners as recommended by panel manufacturer. Do not expose fasteners except where unavoidable and then match finish of adjoining metal.

2.04 TRIM

A. The system manufacturer shall furnish extruded trim. Installation shall be by the certified wall systems contractor, except for those that require completion of the work by other trades, such as gravel stops.

2.05 STORAGE AND HANDLING OF MATERIALS

A. Store materials out of the weather, in a clean, dry, area. Elevate one end of each container to allow for moisture run-off.

B. Panels and/or flashing with strippable film shall not be exposed to direct sunlight or extreme heat.

C. Store materials in a non-corrosive atmosphere.

D. Prevent contact with any substance which may cause discoloration in the applied finishes during storage.

E. Care should be taken during handling of materials to prevent bending, twisting, abrasion, scratching, denting, etc.

F. Protect all materials and installations from damage by other trades.

PART 3 - EXECUTION

3.01 INSPECTION

A. The wall systems contractor shall check final alignment of the secondary steel supports for the wall system.

B. All materials shall be inspected for damage and conformance to the specifications and shop drawings prior to installation.

C. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify the Architect in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.

D. Surfaces to receive the exterior metal wall system shall be structurally sound.

3.02 FABRICATION

A. All system components shall be prefabricated for field assembly in accordance with the procedures and details shown on the shop drawings.

B. The system components shall be fabricated in accordance with the quality procedures established for the specified UL classifications, FM and building code approvals.

3.03 INSTALLATION

A. Manufacturer shall provide detailed instructions covering the tools, fasteners, sealants, gaskets, and procedures required to assure performance of the wall assembly as specified.

B. Installers of the exterior metal wall system and other related components shall be trained, tested and certified by the manufacturer to erect the specified products.

C. Install the wall system, fasteners, trim and related items in accordance with dimensions and procedures shown on the approved shop drawings and erection drawings.

D. Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals. Paint, bituminuous coating, or sealant as recommended by the manufacturer shall separate dissimilar metals.

E. Work shall be coordinated with other trades as required to insure proper flashing and seals to adjoining construction.

F. Installer must field verify all necessary dimensions prior to fabrication of the exterior metal wall system and trims.

G. All wall systems and related components shall be installed plumb, level and true to line.

H. Do not allow the wall system or trim to come into contact with dissimilar materials which will cause a harmful reaction between the metals. Contact panel manufacturer for recommendations in regard to this matter.

I. Workmanship shall conform to standards set forth in the architectural sheet metal manual as published by SMACNA.

J. Touch-up only minor scratches and abrasions. Any other damaged material deemed unacceptable

to the Architect shall be replaced at no additional cost to the Owner.

K. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support. Each panel shall be checked for proper locking into the previous panel before next panel is installed.

L. All flashings and panel joints requiring caulking shall be applied neatly and to prevent water penetration.

M. Masking should be removed immediately after the installation of the panel as the work progresses.

N. When the metal wall system has been installed, it shall not be considered accepted until issuance of Substantial Completion. If at any time during the installation imperfect panels are encountered, installation should cease and the distributor or manufacturer notified at once.

O. Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20°F to +180°F (-29°C to +82°C). Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted.

P. Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.

Q. Conform to the metal wall system fabricator's instructions for installation of concealed fasteners.

3.04 DAMAGED MATERIALS

A. Damage caused by the manufacturer or contractor shall be replaced or repaired to as-new condition, at no additional cost to the Owner.

B. The Construction Manager for the project shall inspect and approve each completed wall / window area and be responsible for the protection of completed work from damage by other trades.

C. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraised, and broken members.

D. Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.

3.05 ADJUSTING AND CLEANING

A. The General Contractor or his assigns shall remove all protective materials and labels from the wall and window system as the system is erected.

B. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

C. Repair panels with minor damage.

D. Remove masking (if used) as soon as possible after installation. Masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor.

E. Any additional protection, after installation, shall be the responsibility of the General Contractor.

F. Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants.

G. The exterior metal wall system contractor shall be responsible for final cleaning of the wall and window systems due to conditions that occur after the wall systems contractor has completed an area. Cleaning is to be done in accordance with the manufacturer's instructions.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 074293 – METAL FASCIA AND SOFFIT PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION

A. Work included: Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of preformed metal fascia and soffit panels as indicated on the drawings including, but not limited to:

1. Preformed metal fascia panels.
2. Preformed metal soffit panels.
3. Preformed metal closure plates and channels.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 024119 – Selective Demolition
B. Section 054000 – Cold Formed Metal Framing
C. Section 079200 – Joint Sealants

1.04 QUALITY ASSURANCE

A. Standards: Comply with standards specified in this section and as listed in Section 014219.

B. Qualifications of Installers:

1. Throughout the progress of the work of this section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and direct all work performed under this section.

2. Provide adequate numbers of skilled workmen to ensure installation in strict accordance with the approved design.

1.05 SUBMISSIONS

A. General:

1. Comply with the requirements of Section 013300 – Submittal Procedures.

B. Manufacturer's Data:

1. Manufacturer's current specifications and other data required to demonstrate compliance with the specified requirements.

2. Manufacturer's recommended installation procedures.

3. Complete materials list of all items proposed to be furnished and installed under this section.

C. Shop Drawings:

1. Submit detailed shop drawings, with all dimensions, gauges of metal, and details of construction to include fastening methods, weatherproofing, and terminations of metal panel work.

D. Samples:

1. Submit three samples of each material utilized in the specified colors.

1.06 COORDINATION

A. All work of this section shall be properly coordinated with the work covered under other sections and contracts.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Materials shall be delivered to the job site in the manufacturer's original, unopened packages bearing the manufacturer's name, product name or title, and product description.

2. Delivery shall be made only after storage location has been determined.

B. Storage:

1. Store all materials in a single location approved by the Architect. Storage area is to be kept neat and clean. Any damage to storage area or its surroundings occurring during its use for storage shall be repaired to its original state (Architect's acceptance required). Remove all soiled or used rags, waste, and trash from the storage area every night and take every precaution to avoid damage by fire.

C. Handling:

1. Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.

2. Position materials to allow for moisture run-off.

3. Do not place materials with strippable film in direct sunlight or extreme heat.

4. Care should be taken during handling of materials to prevent bending, twisting, abrasion, scratching, denting, etc.

1.08 REPLACEMENTS

A. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.09 GUARANTEES

A. Upon completion of the work of this section, and as a condition of its acceptance, deliver to the Owner a written guarantee, signed by the Contractor and installing Subcontractor, agreeing to repair or replace all defective work and all other work damaged in the event of failure from any cause other than a structural failure of the building or malicious damage, as outlined in Section

017000: Contract Closeout, without additional cost to the Owner.

B. A thirty (30) year paint finish guarantee from paint manufacturer with products coated with a fluoropolymer, 70% PVDF finish.

C. The above parties further agree to repair or replace all defective work at their own expense during the term of the guarantee.

PART 2 - PRODUCTS

2.01 GENERAL

A. Design is based on use of 'Metafor Fascia, Wind-lok Soffit Panels or Opaline Soffit Panels' as manufactured by Atas International, Inc. Corporate Headquarters: Allentown, PA 18106 Phone: (800) 468-1441 Website: www.atas.com Email: info@atas.com. The terminology used may include reference to that manufacturer's or to other manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

B. Products used shall be those upon which design is based as noted on the drawings or shall be equal products approved in advance by the Architect.

C. Materials:

1. 'Metafor Fascia Panels' MFP120 or Architect approved equal.

   a. .040 aluminum.
   b. Smooth texture.
   c. 70% PVDF Standard finish or custom finish as selected by Architect.

2. 'Wind-lok Soffit Panels' MPV120 or Architect approved equal.

   a. .032 aluminum.
   b. 12" vented.
   c. 70% PVDF Standard finish or custom finish as selected by Architect.

3. 'Opaline Soffit Panels' OPF, OPN, OPM or OPW or Architect approved equal.

   a. .042 aluminum.
   b. Smooth texture.
   c. 70% PVDF Standard finish or custom finish as selected by Architect.

4. Closure Plates:

   a. 12 gauge aluminum.
   b. 70% PVDF Standard finish or custom finish as selected by Architect. Color to match fascia panels.

5. Closure Channels:

   a. .040 aluminum.
   b. 70% PVDF Standard finish or custom finish as selected by Architect. Color to match fascia and soffit panels.

6. Fasteners and spacing to be as per manufacturer's recommendations.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this section will be performed for any interferences or conditions which will be detrimental to timely and proper completion of the work.

B. Report any interferences or unsatisfactory conditions to the Architect in writing. Do not proceed until interferences or unsatisfactory conditions have been removed or corrected.

3.02 INSTALLATION

A. Contractor must field verify all necessary dimensions prior to fabrication of metal panels and trims.

B. All panels and related components shall be installed plumb and true to line.

C. Do not allow panels or trim to come into contact with dissimilar materials which will cause a harmful reaction between the metals. Contact panel manufacturer for recommendations in regards to this matter.

D. Workmanship shall conform to standards set forth in the architectural sheet metal manual as published by SMACNA.

E. Touch-up only minor scratches and abrasions. Any other damaged material shall be replaced.

F. Each panel shall be checked for proper locking into the previous panel before next panel is installed.

G. All flashings and panel joints requiring caulking shall be applied neatly and to prevent water penetration.

H. Masking should be removed immediately after the installation of the panel and as the work progresses.

3.03 CLEAN-UP

A. Installer is to leave work areas and panels clean, free from grease, finger marks, and stains.

B. Remove scrap and debris from surrounding areas and grounds.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 074600 – VINYL SIDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract including General and Supplementary Conditions and Division 01 Specification Section apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Work shall include, but is not limited to, the following:

1. Provide and install new vinyl siding, soffits, fascia, accessories, trim, and similar items required for proper installation.

B. Related Sections include the following:

1. Section 061000 – Rough Carpentry
2. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
3. Section 079200 – Joint Sealants

1.03 REFERENCES

A. ASTM D7793 – Standard Specification for Insulated Vinyl Siding
B. ASTM D 3679 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding
C. ASTM D 4477 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Soffit
D. ASTM D 5206 - Standard Windload Resistance Test
E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
F. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials
G. ASTM D7254 – Standard Specification for Polypropylene (PP) Siding

1.04 DESIGN/PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Code compliance in accordance with the IBC and IRC.

B. PVC Fire Resistance: Provide vinyl siding products that meet or exceed the following ratings:

1. Flame Spread Index < 25, per ASTM E 84.
2. Fire endurance classification of 1 hour, per ASTM E 119 in a wall assembly.

C. Cedar Impressions Shake and Shingle Siding Fire Resistance: Provide thermoplastic polyolefin siding products that meet or exceed the following ratings:

1. Flame Spread Index <200 per ASTM E-84

1.05 SUBMITTALS

A. Submissions must be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 12 inches long, representing actual product, color, and patterns.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Provide installer with not less than three years of experience with products specified or has obtained 5-Star Green Contractor (Preferred), 5-Star Contractor (preferred), or Master Craftsman credentials from CertainTeed.

B. Mock-Up: Provide a mock-up for evaluation of installation techniques and workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship and color is approved by Architect.
3. Reinstall mock-up area as required to produce acceptable work.

C. The installer must examine the substrate along with adjoining areas to assure proper installation of vinyl siding, fascias, and soffits. All vinyl siding, fascias, and soffits must be installed plumb and true.

1. No plastic material shall be used which has a smoke developed rating of 450 or more when tested in accordance with ASTM E-84, or a smoke density rating of 75 or more when tested in accordance with ASTM D-2843.

2. Plastic materials shall meet the following test criteria:

a. ASTM E-84, Surface Burning Characteristics of Building Materials: flame spread rating shall not exceed 0-25; smoke developed rating shall not exceed 450.
b. ASTM D-635, Flammability of Self-Supporting Plastics: burning test shall not exceed 1.5 inches per minute.
c. ASTM D-1929, Ignition Properties of Plastics: self-ignition shall not occur below 600°F.
d. ASTM D-648, Deflection Temperature of Plastics Under flexural Load: materials shall remain in place 15 minutes at 175°F and fall from frame at 200° below ignition temperature.
e. ASTM D-2843, Standard Method for Measuring Density of smoke from Burning or Decomposition of Plastics: smoke density shall not exceed 75.

1.07 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the job site in the manufacturer's original, unopened package, clearly showing the manufacturer's name, color, and type.

B. All materials must be stored by the contractor off-site prior to installation.

C. All materials must be handled in a manner as to not deform, scratch, or damage. Any materials which are damaged will not be installed and will be removed from the site by the contractor.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacture for optimum results. Do not install products under environmental

conditions outside manufactures absolute limits.

1.09 WARRANTY

A. Provide manufacturer's standard lifetime limited warranty on siding products, transferable to new owners.

PART 2 - PRODUCTS

2.01 MANUFACTURES

A. The design is based on the use of vinyl siding, fascia, and soffit as manufactured by CertainTeed LLC, Siding Products Group, 20 Moores Road, Malvern, Pennsylvania 19355. Tel: (800) 233-8990; Email: salessupportgroup@certainteed.com; Web: www.certainteed.com, and the terminology used may include reference to that manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

B. Products used shall be those upon which design is based or shall be equal products approved in advance by the architect.

2.02 MATERIALS

A. General:

1. Vinyl siding, fascia, and soffit are to be polyvinyl chloride (P.V.C.) and shall comply with the provisions of the National Bureau of Standards voluntary Products Standards P.S. 55.72 and ASTM D-3679: Rigid polyvinyl chloride plastic siding.

2. All vinyl siding will be provided with elongated nailing slots on the flange.

3. All vinyl siding, fascia, and soffits to be nailed with strong, non-corrosive aluminum or galvanized nails.

2.03 VINYL SIDING

A. Monogram D4: (unless otherwise indicated on the drawings)

1. Design: Double 4 inch clapboard; rough cedar finish with STUDfinder Installation System.
2. Nail Hem: RigidForm 210 Technology Roll Over Nail Hem.
3. Lock: CertiLock self-aligning post formed positive lock.
4. Width: 8 inch.
5. Length: 12 feet 6 inches plus or minus .025 inch.
6. Average Thickness: 0.046 inch.
7. Panel Projection: 3/4 inch.
8. Panel Exposure: 4 inch plus or minus .062 inch.
9. Maximum Warp (per 2 panels): 0.250 inch.
10. Color: As selected by Architect from manufacturer’s standards.

2.04 VINYL CARPENTRY SOFFITS

A. Universal T4 soffit, fully vented.

1. Design: Triple 4 inches; fully vented, matte finish.
2. Width: 12 inches plus or minus .062 inch.

3. Length: 12 feet plus or minus .025 inch.
4. Average Thickness: 0.040 inch.
5. Exposure: 4 inches single nailing hem.
6. Maximum Warp (per 2 panels): 0.250 inch.
7. Ventilation: 5.85 sq. inches per sq. ft.

B. Soffit Accessories:

1. J-Channel: 3/8 inch, 1/2 inch, 5/8" and 3/4 inch by 12 feet, 6 inch length, for vertical and eave applications.
2. F-Channel: 5/8 inch and 3/4 inch by 12 feet 6 inches length.
3. Soffit H-Bar: 3/8 inch, 1/2 inch or 3/4 inch by 12 feet, 6 inches length, for horizontal and eave applications.
4. Soffit Cove Trim: 1/2 inch by 12 feet, 6 inches length.
5. Color: As selected by Architect from manufacturer's standards.

2.05 VINYL CARPENTRY ACCESSORIES

A. Standard Accessories:

1. Corner post: Standard width, 10 feet, 12 feet, and 20 feet lengths.
2. J-Channel: Standard width, 12 feet, 6 inches length.
3. Undersill trim: ¾" face, 12 feet, 6 inch length.
4. Dual undersill trim: ¾" face, 12 feet 6 inches length.
5. 2-1/2 inch Metal Starter Strip. (No Color)
6. 2-1/4 inch Vinyl Starter Strip. (No Color)
7. Color: refer to CTS002 for color availability of accessories.

B. 1-1/4 Inch Pocket Accessories:

1. Cornerpost: Standard width, 10 feet; length.
2. J-Channel: Standard width, 12 feet, 6 inches length.
3. Traditional SuperCorner: 5.5 inches by 20 feet length.
4. Inside Cornerpost; Standard width, 10 feet length.
5. 3-1/2 inch Lineal by 20 feet length.
6. Starter Strip: 3 inches by 12 feet, 6 inches length.
7. Band Board: 7-1/4" width by 16'8" length
8. Finish Board: 3-1/2" width by 12'6" length
9. Color: refer to CTS002 for color availability of accessories.

C. Optional Accessories:

1. D7 Straight Edge Perfection Mitered Corner Post, 14 inches.
2. T5 Straight Edge Perfection Mitered Corner Post, 15 inches.
3. D7 Staggered Edge Perfection Mitered Corner Post, 14 inches.
4. D7 Straight Edge Rough-Split Mitered Corner Post, 14 inches.
5. D9 Staggered Rough-Split Mitered Corner Post, 18.5 inches.
6. 2-1/2 inch Window and Door Casing.
7. 2-1/2 inch Vinyl Starter Strip.
8. 5 inch Lineal: 5 inch by 20 feet length.
9. 3-1/2 inch Lineal: 3-1/2 inches by 12 feet, 6 inches length.
10. Cornice Molding: : 2-1/2 inches
11. Crown Molding: 2-1/2 inches by 10 feet length.
12. SuperCorners:
    a. Fluted – 5-1/2 inches by 20 feet length.
    b. Traditional – 6 inches by 20 feet length.

13. Color: refer to CTS002 for color availability of accessories.

2.06 FASTENERS

A. Provide galvanized or other corrosion-resistant nails as recommended by manufacturer of siding products.

PART 3 - ERECTION

3.01 EXAMINATION

A. Prior to commencing work, contractor to verify all governing dimensions of building area to receive vinyl siding.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Examine, clean, and repair as necessary any substrate conditions which would be detrimental to proper installation.

B. Do not begin installation until unacceptable conditions have been corrected.

3.03 INSTALLATION

A. Install products in accordance with the latest printed instructions of the manufacturer.

B. Installer should have current 5-Star Contractor (preferred) or Master Craftsman credentials.

C. Install products with all components true and plumb.

D. *For Vinyl Siding*: Nail horizontal panels by placing nail in center of slot. Nail vertical panels by placing first nail at top of top slot and remaining nails in center of slots. Drive nails straight, leaving 1/16 inch (1.6 mm) space between nail head and flange of panel. (NOTE: Refer to CTS205 Installation Manual for latest installation recommendations) *For Polymer Siding:* Refer to CTS205 Installation Manual for latest installation recommendations.

E. Allow space between both ends of siding panels and trim for thermal movement. Overlap horizontal panel ends one-half the width of factory pre-cut notches.

F. Stagger lap joints in horizontal siding in uniform pattern as successive courses of siding are installed.

G. Install J-channel and flashing to accommodate successive courses of vertical siding. Install wood shims at building corners to bring cut edges of vertical siding out to correct plane.

H. Erect all siding, fascias, and soffits plumb, level, in line, securely anchored in proper alignment, properly related to other parts of the work, and free of waves, buckles, or other defects.

I. All vinyl siding, soffits, and fascia members to be installed as per manufacturer's installation specification.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 CLEAN UP

A. Upon completion of installation of vinyl siding, fascia, and soffit, contractor shall remove all scraps from job site.

B. Contractor shall clean all siding, fascia, and soffit of any marks, dirt, grease, etc. along with any adjacent areas which may also be soiled from installer of vinyl siding, fascia, and soffit.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 075323 – EPDM ROOFING SYSTEM FULLY ADHERED

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of Work:

1. Provide and install modified E.P.D.M. system where shown on the drawings and specified herein. Work shall include, but not be limited to the following:

    a. Furnish and install EPDM roofing system with flashings and all other incidental and accessory items to comprise a complete roofing system.
    b. Removal and disposal of existing roofing and insulation to the depths as shown on the Contract Drawings or as required for the new installations.
    c. Installation of New vapor barrier to the existing deck.
    d. Installation of New tapered roof insulation as indicated on drawings.
    e. New single-ply, thermoset roof system, 60 mil reinforced EPDM sheet system, fully adhered membrane.
    f. New wall and base flashing, expansion joints.
    g. Cleaners, adhesives, sealants, seaming tapes, tape primers and fasteners.
    h. Flashing of all new roof penetrations.
    i. New primary roofing manufacturer’s gravel stops, wall copings and/or counter flashing and termination bars.
    j. Miscellaneous sheet metal or metal flashing.
    k. Provision and installation of new drains, connecting piping, and insulation where indicated.
    l. Manufacturer's Guarantee.
    m. New wood blocking and anchor bolts around roof perimeter, roof penetrations, and similar locations, as required for the complete installation of the roofing system, and to meet new perimeter edge heights.
    n. Installation of new equipment curbs where indicated.
    o. Walkways where indicated.
    p. Provision of new tapered cants as required to meet new blocking at perimeter edges.
    q. Raising roof hatches as required to 8" above finish roof, as a result of the work required to raise finished roof surfaces.
    r. Raising skylights as required to 8" above finish roof, as a result of the work required to raise finished roof surfaces.
    s. Plumbing, mechanical or electrical modifications as required for completion of the installation.
    t. Re-securement of roof decking as required by the contract documents.

B. Related Work/Requirements Specified Elsewhere:

1. Section 012100 – Allowances – Where indicated.
2. Section 061000 – Rough Carpentry – for wood nailers, cants, curbs and blocking.
3. Section 076000 – Flashing and Sheet Metal – for metal roof penetration flashings, flashings and counter flashings.
4. Section 079200 – Joint Sealants

1.02 GENERAL

A. The intention of this specification is to outline the entire roofing project, describing materials, methods, job conditions, etc., so that during the entire construction period, a complete watertight condition is maintained, and at completion, a new roofing system shall be installed.

B. The Instructions to Bidders, the General Conditions of the Contract for the Construction for Buildings prepared by the American Institute of Architects, the Supplementary General Conditions, and the General Requirements are part of this specification whether bound herewith or not, and the Contractor shall refer to them for instruction pertaining to his work.

1.03 ALTERNATES

A. Where so indicated the Contractor shall consult the "Bid Proposal Form" and read all alternates and assure himself whether or not they will add to, deduct from, or in any way affect the cost of the work under this section of the specifications. He shall include all such applicable alternates in his proposal.

1.04 REFERENCE STANDARDS

A. General: References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards are deemed mandatory and applicable to the Work.

B. Factory Mutual (FM) Engineering Corporation, Norwood, MA - Roof Assembly Classifications.
C. Building Code of New York State
D. FS HH-I-526 - Insulation Board, Thermal (Mineral Fiber).
E. FS HH-I-529 - Insulation Board, Thermal (Mineral Aggregate).
F. FS HH-I-530 - Insulation Board, Thermal (Urethane).
G. FS HH-I-551 - Insulation Block and Boards, Thermal (Cellular Glass).
H. FS LLL-I-535 - Insulation Board, Thermal (Cellulosic Fiber).
I. ASTM D 1079 - Standard Terminology Relating to Roofing and Waterproofing
J. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.
K. Underwriters Laboratories (UL), Northbrook, IL - Fire Hazard Classifications.
L. Sheet Metal and Air-Conditioning Contractors National Association, Inc., Chantilly, VA (SMACNA).
M. CGSB 37GP56M Classification: Type 2, Class C, Grade 1.
N. American Society for Testing and Materials (ASTM)
O. Occupational Safety and Health Administration (OSHA), Washington, DC
P. Polyisocyanurate Insulation Manufacturers Association (PIMA) – Bethesda, Maryland – Average Weighted R-Values of roof insulation products.
Q. Single Ply Roofing Industry (SPRI), Waltham, MA – Wind Design Standard for Edge Systems Used in Low Slope Roofing Systems.

1.05 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Jobsite Safety: Execute all operations and provide a safe work environment in accordance to OSHA standards and regulations. This requirement applies to all contractor personnel, associated subcontractors, workers in other trades, and jobsite visitors.

1. Follow all industry fire prevention guidelines for storage of materials, staging areas, roof access, and application means and methods.

2. Any applicable local fire codes supersede industry guidelines.

D. Wind Loads: Provide a roof system, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of the 2015 International Building Code or the American Society of Building Engineers' ASCE7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever is more stringent. **Refer to drawings for Wind Design Data.**

E. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-105.

2. Hail Resistance: MH.

1.06 SYSTEM DESCRIPTION

A. For the purposes of this specification, the roofing system has been based upon products manufactured by:

1. Johns Manville Roofing Systems Group, Denver CO
2. Carlisle Syntec Systems, Carlisle PA
3. or as approved equal by the Architect.

B. System Description:

Vapor barrier, tapered insulation, cover board, and a single ply membrane system. Include all required pre-manufactured copings, gravel stops, and flashings and blocking as required, to provide complete roofing system warranty, whether detailed on the drawings or not.

1.07 SUBMITTALS

A. Comply with the requirements of Section 013300 – Submittal Procedures, and as modified below. All submittals shall be submitted prior to the Pre-Installation Conference.

B. Manufacturer's Product Data sheets and installation instructions on all materials proposed for use. This shall include catalogue sheets, specifications, and installation instructions for each material specified. Submit an intent to warrant, executed by an authorized representative of system manufacturer, indicating that the manufacturer has reviewed drawings, specifications and conditions affecting the work and, and proposes to provide warranties as referenced herein without further stipulation.

C. Manufacturer's Warranty: Submit a sample copy of the membrane manufacturer's standard 20 year No Dollar Limit roofing warranty, covering workmanship and materials.

D. U.L., F.M. and S.P.R.I Compliance Data: Contact roofing manufacturer for information.

E. Shop drawings indicating setting plan for tapered insulation. (Field verify exact location of drains prior to submittal). Submit an accurate layout of the tapered insulation, designed and provided by the membrane manufacturer, showing all slopes to drains. Show cross section drawings illustrating the location and thickness of the tapered insulation pieces and filler pieces; show the thickness of the insulation system at high and low points.

1. Where there is a proposed deviation from the Contract Documents, submit the revised detail labeled as such for approval. On the revised detail, show existing conditions and referenced directly to the related details on the Contract Drawings.

2. Submit an accurate layout of the wood nailers showing their required locations, and required spacing between nailers. Show the direction of the felt run in relation to the slope of the deck and the wood nailers.

F. Samples: All submitted samples must be labeled and supplied by the manufacturer for each submittal package. Submit:

1. (2) Two 12-inch square samples of membrane illustrating the color and thickness to be used;

2. (2) Two 12-inch samples of each roofing membrane type to be used;

3. (2) Two 12-inch samples of all proposed tapered insulation to be used;

4. (2) Two 12-inch samples of all proposed cover-boards to be used;

5. (2) Two samples of each type of fastener proposed to be used.

G. Submit a copy of the manufacturer's installation instructions.

H. Specified roof drain.

I. Shop drawings indicating proposed configuration of perimeter blocking and fastening, if different than that as shown on the Contract Documents.

1. Complete configuration of existing roof indicating layout of membrane sheets, seams between sheets, and location and type of all roof penetrations.

2. Complete details for attaching membrane at perimeter of roof, flashing of roof penetrations, blocking configurations, and other special details as required. This shall include, but not be limited to pre-manufactured gravel stops and copings. Note: Field-fabricated gravel stops and copings will not be permitted.

3. Complete layout of all tapered insulation indicating compliance with drainage patterns as shown on the drawings.

J. Submit list of at least ten (10) successfully completed roofing projects using each of the EPDM roofing systems proposed for use in this project. Include name, address, and telephone number of Owner's representatives. Identify square footage of total installation for each project listed.

1. If the above list of completed projects was not installed by the applicator, submit an additional list of at least four completed EPDM roofing projects installed by the applicator. Include name, address, and telephone number of Owner's Representative.

K. Certifications:

1. **All potential bidders shall submit notarized certification letters from the roofing manufacturer's main corporate offices indicating that the bidder has a minimum of five (5) years previous experience in the specific roofing system applications specified herein, and will provide a list of acknowledged projects to verify same. The contractor must be approved by the roofing system manufacturer for the installation of the primary roofing materials indicated, including membrane and flashing.**

2. Submit certification that roofing systems installed as part of this project comply with the specifications and installation instructions of the roofing system manufacturer.

3. Submit letter from roofing system manufacturer indicating that insulation has been approved by the roofing system manufacturer for use with the roofing system.

4. Submit letter of certification from roofing manufacturer that the specified EPDM systems have been designed to satisfy the specified wind uplift criteria.

5. Submit letter of certification from the Contractor's NYS certified Structural Engineer that the proposed blocking and fastening systems have been designed to satisfy the specified wind uplift criteria necessary to carry the specified roofing system warranty.

1.08 QUALIFICATIONS

A. Applicator's Qualifications:

1. **Roofing applicator must be approved by the manufacturer prior to the bidding period and throughout the installation and able to present a copy of his certification as a part of the bid qualifications package required by this contract. This certification must be an original document as prepared directly by the manufacturer's corporate offices, specific for this contract. Submit certifications from manufacturer pursuant to 1.06Kb above.**

2. **Roofing applicator must have installed and successfully completed at least (10) ten roofs of the same materials and methods specified for this project, completed over the last five (5) years. Submit certifications from manufacturer pursuant to 1.07J above.** (List last ten such jobs within 50 miles of the job site, including address, type of system and number of plies, if applicable, square footage, date installed and owner/agent with whom contracted)

3. **The selected bidder must be a single firm specializing in the types of roofing required, providing undivided responsibility for the performance of all component parts of the roofing system.**

4. **The contractor must be approved by the roofing system manufacturer for the installation of the primary roofing materials indicated, including membrane and flashing, and his firm must be in continuous operation of installing such roofing systems for two years or more.**

5. **The contractor must have at least five (5) years of manufacturer-certified experience in installing commercial scale EPDM roofing systems as required by this specification.**

6. **The contractor must employ roofing application foremen who have successfully completed all training offered by roofing systems manufacturer, including schools, seminars, etc. Provide a letter certifying that the job foreman or crew chief and at least one other member of the roofing crew have installed at least similar systems and are thoroughly familiar with all aspects of the installation. Installation of a minimum of five roofs of comparable size, scope, and complexity as the Work of this Section of roofing**

system specified in the Contract Documents, for which this individual served as field foreman in direct, responsible charge of all roofing work crews. (List last five such jobs within 50 miles of the job site, including address, type of system and number of plies, if applicable, square footage, date installed and owner/agent with whom contracted).

7. **Should the successful contractor opt to utilize the services of a subcontractor for any installations under this contract, the subcontractor shall also meet all requirements of experience and qualifications listed herein required for the Prime Contractor.** Note: No more than 25% of the required installations shall be made by manufacturer-certified subcontractors to the Prime Contractor, in conformance with the Instructions to Bidders section of the Project Manual.

8. Contractor's Required Closeout Submittals: The Contractor shall submit a final invoice for the project, as well as close-out of any and all open change orders. He shall include all final waivers of liens from all material suppliers and subcontractors. (Refer to Section 01700 for additional information.) Provide a completed punch list certification by the Contractor and the Owner's Representative.

B. Manufacturer's Qualifications:

1. The roofing system manufacturer must have a minimum of 10 years experience in the manufacture of EPDM vulcanized thermal-set membranes.

2. **For the work of this contract, the roofing system manufacturer must provide a factory-trained and factory-authorized field representative/technician, employed by the roofing system manufacturer, to supervise this project via a minimum of 10 on site visits, and to review installation procedures and advise applicator on procedures and precautions in use of roofing materials required for final inspection of the roofing system. The cost of this manufacturer's representative, and costs incurred for the supply of same, shall be considered inclusive within the contractor's Base Bid for this project. No exceptions will be made for this requirement. Work shall not begin on this project until this representative has arrived to the project, inspected it, and authorized for work to start. The manufacturer's representative shall sign-in upon each visit with the Construction Manager or designated owners representative, so that accurate attendance records can be kept. The intent of the site visits is that the manufacturer's representative will ensure the quality of the preparation and application of the roof system. The representative will inspect the project on a periodic basis to anticipate problems before they occur, answer questions quickly and look out for the best interest of the Owner. The manufacturer's representative will issue a written inspection report for each visit to be issued to the Owners Representative, Architect & Contractor.**

3. The roofing system manufacturer must provide a NDL warranty (See paragraph 1.14 - "Warranty and Guarantee") upon **satisfactory** installation of the roofing system.

4. All roofing work, including terminations and other work covered under the roofing manufacturer's NDL Guarantee shall be performed by the Prime Contractor. No subcontractors will be permitted on this portion **of** the work.

1.09 REGULATORY REQUIREMENTS

A. Conform to applicable codes for roof assembly fire hazard requirements.

B. Factory Mutual Engineering and Research Corporation (FM):

1. Roof assembly classification of Class 1 Construction, wind uplift requirements as listed below.

a. Wind Uplift Certification: Submit a Letter from the manufacturer of the roofing system that all products manufactured by them including the specific insulation, adhesives and/or fasteners, are included in the specified Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7 for a **120 MPH three (3) second wind gust**.

b. All products shall be listed as Factory Mutual-certified a minimum of one (1) year prior to the date of installation. Submit certifications for both base and top plies as a part of the submittals required for this project.

c. Material Certification: Written certification from the roofing manufacturer certifying that the insulation, insulation fasteners, flashings and accessory products provided by the roofing manufacturer are approved for use with the roofing system and are included in the 20-year No Dollar Limit warranty.

2. Contact roofing manufacturer's technical representative for additional information.

C. Underwriters Laboratories, Inc. (UL):

1. Class A Fire Hazard Classification, as tested in accordance with UL 790.

D. Insulation Criteria:

1. Polyisocyanurate foam insulation shall bear a label certifying that a thermal value was determined in accordance with ASTM C-1289-01.

2. Insulation supplied shall be acceptable to the membrane manufacturer.

E. ANSI/SPRI Wind Design Standard for Edge Systems Used in Low Slope Roofs - All roof edge systems shall comply with the requirements of ANSI/SPRI System Requirement ES1-98 Wind Design Standards Test RE-3. The Contractor shall supply written confirmation of this compliance stating that the roof edge system materials:

1. Exceed 75 lbs./lf outward load in accordance with ANSI/SPRI ES1-98 Wind Design Standards Test Method RE-3; and

2. Exceed 120 lbs./lf upward load in accordance with ANSI/SPRI ES1-98 Wind Design Standards Test Method RE-3.

1.10 PRELIMINARY / PRE-INSTALLATION ROOFING CONFERENCE

A. Before starting roof deck construction, conduct conference at Project site. Comply with requirements for pre-installation conferences as indicated within Division 01 Specifications. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer (if applicable), testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

2. Review means, methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review Project Safety Plan for site conditions, enforcement, compliance, or Owner-imposed restrictions that may be required.

4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

5. Examine site for approved staging areas, disposal sites, and document existing conditions prior to contractor mobilization. Establish scope of work for site restoration and responsibilities.

6. Examine site for condition and completion of areas adjacent to work area. Establish protection required for existing surfaces.

7. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

8. Review structural loading limitations of roof deck during and after roofing operations.

9. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

10. Review governing regulations and requirements for insurance and certificates if applicable.

11. Review temporary protection requirements for roofing system during and after installation.

12. Review work limitation by contractor including; start times, end times, days of the week, noise mitigation, fume control and any part of the work that would effect normal building operations.

13. Review trade coordination necessary for job completion.

14. Review roof observation and repair procedures after roofing installation.

B. Convene prior to commencing work of this section at a time and location to be determined by the Owner or Owner's Representative.

1. All parties responsible for work of this section are required to attend including the Architect, Owner, Contractor, and any other trades involved in the roofing work.

C. The agenda for the Pre-Roofing Conference shall include:

1. Review of all systems and materials to be used in the installation of new roofing, installation procedures and coordination required with related work.

2. Review and coordination of all substrate preparation and related work, including installation of curbs or similar items by others.

3. Review and modify roofing applicators proposed sequencing of the work.

4. Inspect and make notes of job conditions prior to installation.

5. Supply to the Owner’s Representative, a letter from the corporate offices of the roofing manufacturer, which states the name, title, address and phone number of the factory-supplied representatives who will be assigned to this project. No exceptions will be made for this item.

1.11 DELIVERY, STORAGE, HANDLING AND DISPOSAL

A. Deliver all materials and store in their unopened original packaging and rolls with labels intact and legible, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard. Allow no unlabeled materials on site.

B. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.

C. Deliver materials in sufficient quantity to allow continuity of work.

D. Handle rolled goods as to prevent damage to edge or ends.

E. Select and operate material handling equipment so as not to damage existing construction or roofing.

F. Provide continuous protection of materials against wetting and moisture absorption. Store materials a minimum of 6" off the ground, in a dry, well ventilated place protected from the weather. Enclosed trailers are recommended. Heated or Air-Conditioned storage is required for temperature-sensitive items.

G. Properly tie down insulation to prevent blow off. **No material is to be stored on the roof at any time**. Do not point load roof. Do not store any flammables on the roof.

H. Protect materials against damage by construction traffic.

I. Comply with fire and safety regulations.

J. Protect membrane and flashing materials against coming in contact with coal tar pitch, petroleum, grease, oil, solvents, or other waste products. After exposure to pitch of other waste products, remove contaminated membrane and flashing material from site.

K. Protect materials during delivery to site. Keep materials in safe, dry storage at temperatures recommended by their manufacturers. Materials shall be labeled for ready identification, Label shall include name of manufacturer. **Store materials in a manner so that no direct contact is made with the ground.**

   Storage and Handling: Store materials in a dry, well-ventilated place protected from the weather.

   1. Do not store materials so as to overload the deck or structural assembly; do not stockpile aggregate surfacing materials on roof. Prepare staging for aggregate stockpile that will prevent contamination of the material.

   2. Store all materials on 4” min raised platforms covered with properly secured breathable water resistant covers. Slit shrink wrapping to not permit condensation and cover with breathable tarp.

   3. Mark for clear and evident identification all materials that have been subject to moisture. Remove all materials that become wet from the site.

      a. Store volatile liquids in a separate storage building or trailer, or remove from the site at the end of each workday.

   4. Store volatile liquids at temperatures recommended by the manufacturer.

5. Do not remove materials from factory packaging until ready for use. Handle roll goods with care; do not use roll goods which have been damaged.

6. Store adhesives and sealants at temperatures between 60°F and 80°F.

L. **Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/Engineer.**

M. In the event of damage, immediately make all repairs and replacements required by the Owner's Representative.

N. **Disposal:** All removed materials become the property of the Contractor. Inspect all ground areas surrounding roof on a daily basis for loose debris; immediately move all debris off the roof and into approved dumpsters, ready for legal disposal off-site. Dumpster staging areas must be kept neat and tidy; do not allow to overflow. All debris must be transported to a legal dumpsite or recycling facility, and documentation of each load must be maintained by the Contractor.

1.12 QUALITY ASSURANCE

A. Submit written certification from the roofing membrane manufacturer certifying that the proposed roofing assembly, compatibility of materials and total R-Value of the insulation system meet or exceed these specification requirements. Letter shall state that the specifications and drawing details are acceptable to them for the deck and surfacing to which they are to be applied, that there is a compatibility of all materials provided, and the total R-value of the proposed insulation system. Membrane manufacturer shall also submit a letter certifying that the manufacturer has been actively marketing the submitted system for a minimum of five (5) years.

1. If details for any manufacturer's system proposed in the Contract Documents are not acceptable to the manufacturer, submit corresponding details proposed for the particular application, together with the manufacturer's reasons for not accepting the conditions depicted in the specifications or drawings. No alternate details will be considered without evidence of valid objections on the part of the manufacturer to the contract requirements.

2. No deviation is to be made from this specification without prior written approval by the manufacturer; submit such approval to the Architect.

3. The roofing system manufacturer must provide inspection of guaranteed roofing systems by company employed, salaried personnel dedicated to Technical Services. Sales representatives or sales agents will not be permitted to conduct quality assurance inspections or grant final manufacturers acceptance.

B. EPDM Roofing Applicator Requirements: refer to 1.08-A of this Section.

C. EPDM Roofing Manufacturer Requirements: refer to 1.08-B of this Section.

D. Material Requirements/ Source Limitations:

1. Obtain all membrane sheets, insulation, flashings, prefabricated gravel stops and copings, and all temporary roof materials from a single manufacturer.

E. UL Rating:

1. Provide EPDM membrane and insulation that has been classified by Underwriters Laboratories as a component of Class A roofing system.

F. Wind Uplift:

1. Refer to Article 1.09 of this section.

G. Inspection: Prior to, during installation, and at completion of the installation, an inspection shall be made by a representative of the manufacturer in order to ascertain that the roofing system has been installed according to their published specifications, standards, and details.

1. Warranty will be issued upon approval of the installation (see 1.15 of this section).

H. Test Reports: Provide:

1. **Roof drain and leader test or submit plumber's verification.**

2. **Roof deck adhesive test to be completed by the selected contractor prior to start of their work by a third party company.**

I. **Fire-Test-Response Characteristics:** Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-test Exposure: Class A; ASTM E108, for application and roof slopes indicated.

1.13 JOB CONDITIONS

A. Surfaces on which the roofing membrane system is to be applied shall be clean, smooth, dry, and free of fins, sharp edges, loose and foreign materials, oil and grease.

1. Before beginning work, the authorized representative of the manufacturer shall examine the roof surfaces in order to ensure that all substrates are acceptable, and will ensure the NDL Warranty requirements of this contract.

B. Examine the substrate and the conditions under which roofing work is to be performed, and notify the Architect in writing of unsatisfactory conditions. The Contractor will schedule a coordinated field meeting with the Architect and the authorized manufacturer's representative to review said conditions prior to proceeding with the work. Do not proceed with any work until all unsatisfactory conditions have been corrected.

1. All surface voids greater than 1/4" wide (or limitations as recommended by the roofing manufacturer) shall be properly filled with an acceptable fill material.

C. Moisture Protection:

1. Cover, seal or otherwise protect the roof and flashings so that water cannot accumulate or flow under completed portions. When and where necessary to accomplish this, provide temporary water cut-offs in accordance with the membrane manufacturer's written specifications.

D. Environmental Conditions:

1. Do not smoke or use open flames.

2. Do not apply insulation or roofing materials during rainstorms.

3. Do not apply roofing sheets when wind conditions are such that is difficult to handle the sheets.

4. Proceed with roofing work only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

5. Do not start roofing if rain is imminent, or ambient temperature is below 40 degrees F.

6. If rain occurs during roof membrane application, cease operations and protect deck, insulation, penetrations and membrane from water damage and intrusion.

7. Provide and maintain fire extinguishers.

8. Comply with all fire regulations. Ensure properly rated, charged, and inspected fire extinguishers are on the roof and staging area.

E. Protection:

1. Take necessary precautions to prevent damage of any kind to adjacent material and work for other trades.

2. Provide protection to prevent damage or staining of building surfaces, paved areas and plantings.

3. Provide enclosed chutes for removing debris from roof level, to roof level and to vehicles below. Do not throw debris from roof level.

4. Protect areas of deck repair at the end of each working day. Protection shall be watertight.

5. Provide and maintain operating water pumps on each roof area to keep areas free of water accumulation. Pump water through hoses of sufficient size to functioning roof drains.

6. Drain Verification:

a. Prior to start of roofing removals, in the presence of the Owner's representative, verify that existing roof drains are operational and are not plugged.

b. Submit in writing that the verification of roof drains has been performed. Include listing and location of non-operational drains.

F. Limit removal of existing roofing to the amount (or areas) that can be replaced with the complete new roofing system (including insulation, membrane, flashing, gravel stops, and related work) in a single working day, maintaining a completely watertight covering on the roof.

1. At the end of each work day, or when weather conditions outside manufacturer's recommended limits are predicted, provide and install temporary waterstops as recommended by the roofing manufacturer.

a. Permanent roof insulation shall not be installed as base for temporary waterstops.

b. Remove temporary waterstops completely before installing permanent roofing system.

1.14 WARRANTY AND GUARANTEES

A. Contractor's Guarantee: Furnish contractor's guarantee in accordance with Section 017000 for all materials and workmanship starting from date of Substantial Completion. Replace defective roofing at no expense to the Owner.

B. Manufacturer's Guarantee: Furnish manufacturer's twenty (20) year Guarantee similar or equal to

1. Johns Manville's "Peak Advantage No Dollar Limit Roofing System Guarantee".

2. Carlisle Syntec's "Golden Seal Total Roofing System No Dollar Limit Edge to Edge Warranty".

Include year membrane guarantee. Guarantee shall cover both labor and materials necessary to effect repairs, with No Dollar Limit as to effect roof repairs and accidental puncture up to 16 man-hours per year and one hail damage. Single-source special warranty includes: roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover board, walkway products, manufacturer's expansion joints, membrane edge metal products (Edge to Edge) and other single-source components of the roofing system marketed by the manufacturer.

1. Guarantee shall include a wind rider for the repair of damages to roofing system caused by winds up to and including **three-second gust of 120 MPH, 33 feet off the ground** as defined by the Beaufort scale.

C. These specifications may require more than what the manufacturer may require for providing a warranty for the roofing system.

D. The NDL Warranty shall be accompanied by a letter from the manufacturer's corporate office, attesting that the entire roofing installation was inspected during the complete course of the project by the factory-authorized representative, who shall be named, and that the entire installation is certified compliant to the manufacturer, and worthy of the required warranty.

1. The NDL warranty shall include, but not be limited to the following conditions:

a. Cracking due to expansion or contraction of the membrane.

b. Deterioration due to exposure to the elements.

c. Decomposition of membrane due to ponding water.

d. Separation of factory and field fabricated seams and joints.

e. Cracking or deterioration of membrane materials from trapped water vapor under membrane.

f. Separation of or decomposition of membrane flashing.

g. Wind damage sustained up to Factory Mutual Class I-110 classification.

2. Provide that in the event the roofing system fails to perform, the roofing systems manufacturer will, at its own expense, cause to be made the repairs or modifications to the roofing system necessary to affect water-tightness and will re-inspect the roof and reissue the guarantee after reinspection.

3. In the event repairs are required due to natural disasters, unauthorized alterations, or other causes specifically excluded in the guarantee, the manufacturer will reinspect the roof and reissue the guarantee provided that the methods and materials used in the repair have received prior approval by the manufacturer and the repairs are accomplished by an approved applicator.

4. The manufacturer shall inspect the roof area under this contract every five (5) years of the duration of the warranty period and will provide written observation and associated specific maintenance recommendations, as applicable, to the Owner.

E. **The Contractor is to cover damages to the building resulting from failure to prevent penetration of water during construction.**

F. Pro-rated System Warranties shall not be accepted.

G. Warranty Period: Twenty (20) years from the date of Substantial Completion and must include a 120 mph wind speed rider as required by ASCE-7 of the Building Code of the State of New York.

H. Manufacturer shall have a minimum AAA credit rating; provide written verification of same to Architect as a part of the submittals for this project.

I. **Applicator's Guarantee:**

1. **Special Project Warranty: Submit roofing installer's warranty, signed by the Installer, covering the work of this section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, perimeter metals and walkway products, for the following warranty period: 2 years.**

1.15 LABORATORY TESTING

A. Upon request from the Owner or Architect, the roofing membrane manufacturers shall supply, at their expense, the results of mechanical and chemical testing performed on the materials supplied.

B. The tests shall be performed to certify compliance with the standards referenced under this section.

1.16 SITE PROTECTION

A. During roofing work, exposed surfaces of finished walls and ground shall be protected with tarps in order to prevent damage. Contractor shall assume full responsibility for any damage.

B. All work relative to this roof project shall include the use and installation of temporary partitions as necessary and required to adequately satisfy the needs for the separation of construction requirements of Section 013500.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For the purposes of this specification, and to identify a minimum level of quality, the design is based on the use of either:

1. Johns Manville Roofing Systems Group; Denver, CO.

2. Carlisle Syntec Products; Carlisle, Pa.

3. Or an approved equal by the Architect.

B. **Such references shall be construed only as establishing the quality of materials and workmanship to be used under this section, and shall not, in any way, be construed as limiting competition by other manufacturers offering products of identical material composition. Products used shall be those upon which the design is based, or shall be equal products, by the Architect.**

C. **Bidders / Applicators seeking approval for substitute materials shall submit their request in writing to the Architect in accordance with the requirements of the Project Manual.**

2.02 ROOFING MEMBRANE

A. Ethylene Propylene Diene Monomer (EPDM) – rubber roofing membrane-compounded elastomer meeting the following properties: Specifications are based on:

1. Johns Manville's **JM EPDM R 60 FR** Reinforced Membrane sheet with Factory Inseam Tape: 4 inch (101.6-mm) wide butyl splice tape with release film

2. Carlisle Syntec's **Sure-Tough 60-mil** Reinforced EPDM (Ethylene, Propylene, Diene Terpolymer) in the largest sheet possible with 3" or 6" Factory-Applied Tape (FAT).

B. Reference Standard: ASTM D4637, Type II.

C. Typical Physical Properties:

1. ASTM D751 - Thickness (min., sheet-overall): 0.060 inches.
2. ASTM D412 - Tensile Strength (min.): 1305 psi (9.0 MPa).
3. ASTM D5635 - Dynamic Puncture Resistance: Pass.
4. ASTM D5602 - Static Puncture Resistance: Pass.
5. ASTM D751 - Elongation (Ultimate, min.): 300%.
6. ASTM D412 - Tensile (set, max.): 10%.
7. ASTM D624 - Tear Resistance (min.): 110 lbf/in. (26.27 kN/m).
8. ASTM D2137 - Brittleness Point (max.): -45°C (-49°F).
9. ASTM D1149 - Ozone Resistance (no cracks): Pass.
10. ASTM D573 - Heat Aging:

    a. ASTM D412 - Tensile Strength (min.): 1250 psi (8.3 MPa).
    b. ASTM D412 - Elongation (ultimate, min.): 200%.
    c. ASTM D624 - Tear Resistance (min.): 125 lbf/in. (21.0 kN/m).
    d. ASTM D751 - Linear Dimension Change (max.): +/-1%

11. ASTM D471 - Water Absorption (max.): +8/-2 mass %.
12. ASTM G151 - Weather Resistance: G-151,

    a. ASTM G155 - Visual Inspection: Pass.
    b. PRFSE (min.): 30%.
    c. Elongation (Ultimate, min.): 200%.

D. Membrane Layer Securement: Adhered. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

1. JM EPDM Membrane Adhesive (Low VOC)

2. Carlisle Syntec EPDM x-23 Low-VOC Bonding Adhesive

E. Installation Accessories:

1. Detail Membranes and Strips:

    a. EPDM Peel & Stick Flashing: A 6-inch or 12-inch wide, uncured EPDM sheet, with a factory laminated, self-adhering EPDM/butyl tape. Product shall be similar or equal to:

        1) JM EDPM Peel & Stick Flashing

2) Carlisle EPDM PS Elastoform Flashing

b. EPDM Peel & Stick Sealing Strip: A 6-inch, 9-inch or 12-inch wide EPDM strip, with factory laminated, self-adhering seam tape. Product shall be similar or equal to:

1) JM EDPM Peel & Stick Sealing Strip
2) Carlisle PS Cured Cover Strip

c. EPDM Seam Tape: A 6-inch wide, self-adhering, cured EPDM/butyl rubber splice tape for use between EPDM sheets. Product shall be similar or equal to:

1) JM EPDM Seam Tape
2) Carlisle Sure Seal Seam Tape

d. EPDM Reinforced Termination Strip (RTS): A black, 6-inch wide, 45 mil thick, polyester scrim-reinforced, cured EPDM strip. Product shall be similar or equal to:

1) JM EPDM Reinforced Termination Strip (RTS)
2) Carlisle EPDM Reinforced RUSS Strip

e. EPDM Reinforced Termination Strip (RTS) With Tape: A black, 6-inch wide, 45 mil thick, polyester scrim-reinforced, cured EPDM strip with a factory-laminated, 3 inch self-adhering seam tape. Product shall be similar or equal to:

1) JM EPDM Reinforced Termination Strip (RTS) With Tape.
2) Carlisle EPDM Reinforced RUSS Strip

2. Manufacturer Pre-Molded Flashings:

a. EPDM Peel & Stick Inside/Outside Corners: A 60 mil thick, uncured flashing with a pre-applied peel and stick tape. Product shall be similar or equal to:

1) JM EPDM Peel & Stick Inside/Outside Corners
2) Carlisle EPDM PS Inside/Outside Corners

b. EPDM Peel & Stick T-Joint Patches: An 8” x 8” wide, uncured EPDM sheet with a factory laminated, self-adhering EPDM/butyl tape. Product shall be similar or equal to:

1) JM EPDM Peel & Stick T-Joint Patches
2) Carlisle EPDM PS T-Patches

c. EPDM Peel & Stick Pipe Boot: A conically stepped pre-molded EPDM membrane with a pressure-sensitive tape on the flange. Product shall be similar or equal to:

1) JM EPDM Peel & Stick Pipe Boot
2) Carlisle EPDM PS Pipe Boot

d. EPDM Pipe Boot: A conically stepped pre-molded EPDM membrane. Product shall be similar or equal to:

1) JM EPDM Pipe Boot
2) Carlisle EPDM PS Pipe Boot

3. Sealants and Coatings:

    a. Sealing / Water Cutoff Mastic: A one-component, low viscosity, self-wetting, butyl blend sealant. Product shall be similar or equal to:

        1) JM Sealing Mastic
        2) Carlisle Water Cut Off Mastic

    b. EPDM Tape Primer: A solvent-based primer for seaming EPDM laps. Product shall be similar or equal to:

        1) JM EPDM Tape Primer
        2) Carlisle EPDM Low VOC Primer

4. Liquid Flashing: two-component polyurethane-based system which creates a reinforced, cold-applied liquid flashing that is compatible with all EPDM, TPO, PVC, and KEE HP membranes:

    a. Carlisle LIQUISEAL® Liquid Flashing

5. EPDM Walk Pad:

    a. EPDM Walkpads: A heavy-duty, non-porous, solid rubber walk pad. Product shall be similar or equal to:

        1) JM EPDM Walkpads
        2) Carlisle EPDM Walkway Pads

        Typical Physical Properties:

            a) ASTM D297 - Specific Gravity, Water Displacement Method - Specific Displacement Method: 1.06-1.15 gm/cm.
            b) ASTM D624 - Tear Resistance Die C: Specimens Tested at 20 in./min. (500 mm/min.): 250 lbs./in (43.8 kN/m).

6. Edge Strip:

    a. Tapered Fesco Edge Strip: Shall be manufactured from Fesco Board, which is composed of expanded perlite, a volcanic ore, and blended with selected binders and fibers. Product shall be similar or equal to: Tapered Fesco Edge Strip.

        Reference Standard: ASTM C728.

        Typical Physical Properties:

            a) ASTM C209 - Water Absorption (% by Volume - 2 hours): 1.5 maximum.
            b) ASTM C165 - Compression Resistance:

                i. 5% Consolidation: 30 psi (207 kPa).
                ii. 10% Consolidation: 40 psi (276 kPa).

            c) ASTM C209 - Laminar Strength: 7 psi (48 kPa).
            d) ASTM C203 - Flexural Strength: 65 psi (448 kPa).
            e) ASTM C209 - Product Density: 9 psf (144 kgs./m3).
            f) ASTM C209 - Dimensional Stability: 0.5% maximum.

        Drains: Provide similar or equal to Hercules RetroDrain.

7. Expansion Joint Covers:

    a. Expand-O-Flash Styles: CF, CFEJ, EJ, EJ/WC

8. Roof Edging System - Fascia: (Where shown on drawings)

    a. Provide a decorative metal fascia with continuous extruded aluminum bar to terminate roofing at perimeter. Provide watertight system with no fasteners. Product to be similar or equal to:

        1) JM Presto-Tite
        2) Carlisle Securedge 2000

        Typical Performance Characteristics:

            a) Provide meeting or exceeding the requirements of ES-1 and IBC.
            b) Provide extruded bar locks membrane.
            c) Provide injection-molded EPDM anchor bar thermal expansion splices.
            d) Provide a fascia that freely thermally cycles on extruded bar.

        Typical Physical Properties:

            a) Provide fascia metal gauge: .040” thick formed aluminum.
            b) Provide fascia: Standard 12’-0” (3.65 m) lengths.
            c) Provide extruded bar: Continuous 6063-T6 alloy aluminum in 12’-0” (3.65 m) standard lengths with pre-punched slotted holes and all bar miters welded.
            d) Provide fasteners: #9 x 2” stainless steel with drivers.
            e) Provide exterior fascia finishes: Under Base Bid costs, the Architect shall have the option to choose from: natural mill finish, Kynar 500 from manufacturer’s standard colors, custom color Kynar 500, or clear or color anodized. No additional charges shall be made to Owner for Architect’s selection.

        Accessories:

            a) Provide miters, downspout scuppers, and spill-out scuppers as fabricated by the manufacturer.
            b) Employ welded base assembly to maintain watertight integrity.
            c) Provide matching brick wall cap, downspout, extenders or other special fabrications as detailed.

9. Roof Edging System - Coping: (Where shown on drawings)

    a. Provide a decorative metal coping with continuous extruded aluminum bar to terminate roofing at perimeter. Provide watertight system with no fasteners and butt-type joints with concealed splice plates. Product to be similar or equal to:

        1) JM Metal Presto-Lock
        2) Carlisle Securedge 200

        Typical Performance Characteristics:

            a) Provide design that allows coping sections to expand and contract freely, while locked in place on anchor cleats.
            b) Provide design that allows coping sections to be locked to extruded aluminum anchor bar and anchor cleats by mechanical pressure from hardened stainless steel springs factory-attached to the anchor cleats.

c) Provide all splice plates, include factory-applied dual non-curing sealant strips capable of providing a watertight seal.

Performance Requirements:

a) FM 1-90 approved.
b) Exceeds 75 lbs. per lf outward load in accordance with ANSI/SPRI ES-1-98 Wind Design Standards Test Method RE-
c) Exceeds 120 lbs. per lf upward load in accordance with ANSI/SPRI ES-1-98 Wind Design Standards Test Method.

Typical Physical Properties:

b) Coping Cover:

i. Provide snap-on cover, 12 feet (3.65 m) long, with matching 8 inch (203 mm) wide concealed splice plate and two factory-applied non-curing sealant strips.

ii. Provide .050 inch (1.3 mm) thick aluminum in with Kynar 500 finish.

c) Extruded Anchor Clip:

i. 12 inch (304 mm) long, 20 gauge (1.0 mm), G-90 galvanized steel anchor clip with two hardened stainless steel springs per clip.

d) Fasteners:

i. Provide corrosion-resistant #12 x 1-5/8 inch (41 mm) long, with hexagonal head and 5/8 inch (16 mm) bonded washer with EPDM washer seal.

ii. Provide equivalent corrosion-resistant fastener of type and size required for specific substrate types.

e) Accessories:

i. Provide miters, downspout scuppers, and spill-out scuppers fabricated by manufacturer.

ii. Employ welded base assembly to maintain watertight integrity.

iii. Provide matching brick wall cap, downspout, extenders or other special fabrications as detailed or required for a complete and proper project.

2.03 WOOD BLOCKING, PLYWOOD AND CANTS

A. Blocking Thickness: Size as indicated or required to bring blocking flush with top surface of insulation and tapered edge strips.

B. Plywood Thickness: As required to bring wood blocking flush with top surface of insulation and tapered edge strips.

C. Install plywood on all masonry surfaces contaminated with asphalt or coal tar.

D. Species: Southern Yellow Pine.

E. Treat on all surfaces, including field cuts.

F. All nailers and blocking material to be free of wane, shake, decay or checks, and pressure treated with water-borne preservatives for above ground use, AWPA LP-2. Standard and kiln dried to a maximum of 19% moisture content. Wood shall be dressed on all sides.

1. Shall be #2 or better lumber, and conform to the current JM and NRCA recommendations on wood nailers as well as conform to the FM Global Loss Prevention Data Sheet 1-49. Creosote and asphaltic preservatives are not acceptable.

G. In order to provide minimum tapered insulation profiles as necessary, the contractor may need to provide alternate perimeter blocking (and fastening) details, based on verified field conditions. The cost of any field modifications required shall be at no additional cost to the Owner. All blocking attachments shall be certified by a NYS licensed Professional Engineer (who is retained by the Contractor on a consultant basis) certifying that the connections as designed meet or exceed the wind uplift requirements of the roofing system.

2.04 INSULATION

A. Tapered: Tapered R30 minimum

1. JM Energy 3
2. Carlisle Insulbase

a. Polyisocyanurate foam with fiberglass facer on both sides. Manufactured using Pentane as a blowing agent.
b. ASTM C1289-01, Type II, Class I, Grade II (20 psi)
c. Maximum Panel Size: 4 feet x 4 feet. R-value: 5.7 per inch.
d. Tapered Insulation: 1/8 inch per foot.
e. Taper crickets 1/4 inch per foot crickets. R-value: 5.7 per inch.
f. Compressive Strength: 20-psi minimum at any point. ASTM D1621-73.
g. Flame Spread: 25 or less, ASTM E-81-81.
h. Moisture vapor transmission: ASTM C355, less than 1 perm.
i. Water absorption: ASTM C209, less than 1%.
j. Dimensioned stability: ASTM D2126, 2% maximum 24 hours.
k. Factory Mutual approved and Underwriter's Laboratories listed.

B. Flat Stock: Base Layer –20 psi (minimum R Value of 30.) Two (2) layers of 2.6 inch in Structurally Sloped areas.

1. JM Energy 3
2. Carlisle Insulbase

a. ASTM C-1289-01. Type II, Class I, Grade II.
b. Polyisocyanurate foam, fiberglass facer on both sides, manufactured using Pentane as the blowing agent.
c. "R" value: 5.7 per inch
d. Compressive Strength: 20 psi minimum, ASTM D1621-73
e. Flame Spread: 25 or less, ASTM E-81 81.
f. Moisture vapor transmission: ASTM C355, less than 1 perm.
g. Water Absorption: ASTM C209, less than 1%.
h. Dimensioned stability: ASTM D2126, 2% maximum 24 hours.
i. Factory Mutual approved and Underwriter's Laboratories listed.

C. All insulation shall meet or exceed the following requirements when tested in accordance with ASTM E-84:

a. Flame spread less than 25.

b. Smoke developed less than 450.
c. Fuel contributed less than 100.

2.05 ROOF COVER BOARDS (one of the following)

A. Cover Boards

1. Top Layer: Johns Manville's Invinsa Roof Board or Carlisle Securshield HD Plus

a. Cover Board: 1/4 Inch thick.
b. High Density closed cell polyisocyanurate foam board with clay-coated fiber glass facer.
c. Minimum Compressive strength: 150 psi (1034 kPa).
d. Flexural Strength: 2000 psi, ASTM D 1037; 28 lbf ASTM 1037
e. Dimensional Stability: >0.6%, ASTM 2126
f. Moisture Vapor Permeance: <1 perm, ASTM E 96
g. R-Value: 1.0 (hr•ft2•˚F)/Btu, ASTM C 518
h. Water Absorption (max) 2.6%, ASTM C 209
i. Surface Water Absorption: <1 gram, ASTM C473
j. Mold Resistance: Pass, ASTM D 3273
k. Weight per 4 x 8 Sheet: 12 lbs (plus or minus 2 lbs)

2. Top Layer: DEXcell roof board manufactured by National Gypsum Corp or Dens Deck Primed roof board manufactured by Georgia Pacific, supplied by Carlisle

3. High Density Gypsum Core Roof Cover Board: Provide gypsum core panel acceptable to the roofing system manufacturer and complying with Factory Mutual requirements for FM approval for Class 1. Gypsum core panel shall be 5/8th inch thick primed fire stop Type X, gypsum core with fiberglass matte facing on both sides. Gypsum core panel shall be fire resistant and meet UL 790 with a Class A Fire Rating.

Typical Physical Properties:

1. Thickness: 5/8 inch, nominal.
2. Width: 4 feet (1.22 m).
3. Length: 4 feet (1.22 m), standard.
4. ASTM C473 Method B, Flexural Strength: Parallel 100 lbs. min.
5. ASTM E96 Moisture Vapor Permeance: <23 perm [1314 ng/(Pa•s•m2)]
6. ASTM C518: R-Value 1.0 (hr•ft2•ºF)/Btu (0.18 (m2•ºC)/W).
7. ASTM C473, Water Absorption: 10% max.
8. ASTM D1621 Compressive Strength: 900 psi,
9. ASTM C473 Surface Water Absorption: <1 gram.
10. ASTM D3273 Mold Resistance: Pass.

2.06 GYPSUM SUBSTRATE BOARD FOR CEMENTITIOUS WOOD FIBER AND STEEL DECKS

A. Provide Gypsum Core panel acceptable to the roofing system manufacturer and complying with Factory Mutual requirements for FM approval for Class 1.

B. Gypsum core panel shall be 1/2 inch thick primed fire stop, treated gypsum core with a heavy duty coated fiberglass facer,

1. JM DEXcell FA Glass Mat Roof Board by National Gypsum

2. Dens Deck Primed roof board manufactured by Georgia Pacific, supplied by Carlisle

C. Gypsum core panel shall be fire resistant with zero flame spread and zero smoke developed when tested per ASTM E-84 tunnel test method.

D. Provide Gypsum core panel on all steel and concrete decks when they are in the same roof section as the Cementitious Wood Fiber decks.

2.07 SBS-SELF ADHERED VAPOR BARRIER FOR WOOD DECKS or DECKS WITH SUBSTRATE BOARD

A. Tri-laminate woven polyethylene, nonslip, UV-protected top surface, with a SBS Rubber and asphalt blend with low air and vapor permeability.

1. JM Vapor Barrier SA

2. Carlisle VapAir Seal 725 TR

B. Primer:

1. JM SA Primer Low VOC

2. Carlisle CAV-GRIP III Adhesive/Primer

2.08 SBS-MODIFIED VAPOR BARRIER FOR STRUCTURAL LIGHT WEIGHT, CONCRETE AND GYPSUM DECKS

A. SBS Membrane Vapor Barrier: Thermally fused, Fiberglass reinforced, SBS Modified asphalt sheet; smooth surfaced; suitable for application method specified. Product shall conform to the requirements of ASTM D 6163, Type I, Grade S.

1. Johns Manville DynaBase HW

2. Carlisle Syntec VapAir Seal 725 TR or Sure TG 90 Base Sheet

a. Description: SBS modified bitumen applied onto a fiberglass mat with a sanded underside and high brush sanded topside surface. Nominal thickness – 114 mils.

b. Physical Properties:

1) Minimum Thickness: 90 mil (2.29 mm), minimum.
2) Tensile Strength @ 0°F (-18°C):
   a) Machine Direction: 105 lbs. force/in. width (18.4 kN/m), minimum.
   b) Cross Machine Direction: 95 lbs. force/in. width (16.6 kN/m), minimum.
3) Elongation @ 0°F (-18°C):
   a) Machine Direction: 5%
   b) Cross Machine Direction: 5%
4) Tensile-Tear:
   a) Machine Direction: 100 lbs. force/in. width (17.5 kN/m), minimum.
   b) Cross Machine Direction: 90 lbs. force/in. width (15.75 kN/m), minimum.
5) Low Temperature Flexibility: -30°F (-34°C).
6) Dimensional Stability:
   a) Machine Direction: 0.1% change.
   b) Cross Machine Direction: 0.1% change.

2.09 INSULATION SECUREMENT AND MEMBRANE SECUREMENT FOR TECTUM DECKS

A. Insulation securement shall be:

1. Johns Manville Polymer Auger Fasteners and Plates

2. Carlisle Syntec Gyptec Fasteners and Plates

And shall follow the requirements for spacing and fastener length.

B. Membrane layer securement shall be:

1. JM RetroDriller Fastener

2. Carlisle HP Purlin Fastener

Designed for attaching Single-Ply membrane systems to structural steel purlins. The fastener has a Phillips head and nominal shank diameter of .194 and a thread diameter of .230. Fastener must have corrosion-resistant CR-10 coating, exceeding FM Global Approval Standard #4470 corrosion requirement. The point shall have a ½-inch drill point that can quickly drill into structural purlins a minimum of 1 inch.

2.10 INSULATION SECURE AND MEMBRANE SECUREMENT ON STEEL DECKS

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates on Steel decks meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.

1. JM High Load Fasteners (#14) and RhinoPlates

2. Carlisle HP-X Fastener and Rhinobond Plates

2.11 POURABLE SEALERS

A. Two-component compatible with materials with which it is used.

B. Carlisle One-Part or two-part Pourable Sealer

2.12 FASTENERS

A. Wood Blocking:

1. No. 14 screws with fluorocarbon coating that penetrate the nailer below 1 ¼ inches. Set in two rows staggered at 12 inches on center. Designed for securing wood to wood.

2. Spiral shanked galvanized nails that penetrate the nailer below 1 ¼ inch. Set in two rows staggered at 12 inches on center.

2.13 DECK REPAIR

A. Furnish and install a fast setting concrete mix, Product: Quikrete Fast-Set.

2.14 ROOF CURBS

A. Provide a minimum of one row of wood blocking to top of existing curb to raise the flashing a minimum of 12 inch.

2.15 EXPANSION JOINTS (Where indicated on drawings)

A. Provide new expansion joint cover, curb to wall and/or curb formed, 4” wide and 4” vertical.

2.16 ROOF DRAINS

A. **For New Construction roofs**,

1. Single Drain (Primary Only) Model ZC100-DP-EA-VP as manufactured by Zurn, or approved equal by Architect.

2. Double Drain (Primary with Overflow) Model ZC163-DP-EA-VP-W4 as manufactured by Zurn, or approved equal by Architect.

3. Overflow Drain Downspout nozzle Z-199 SS as manufactured by Zurn, or approved equal by Architect.

B. **For Existing Roofs**, The Contractor shall remove the existing Roof Drain Dome Strainers and Flashing Clamp Rings and discard, clean and prep remaining drain bowl assembly for new roofing. Contractor to Install New Cast Iron Dome Strainers, Flashing Clamp rings and 2" Cast Iron Static Extension Ring, replace all missing or damaged components with new to match as manufactured by Zurn, or approved equal by Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that Work of other trades, which penetrates the roof deck or requires personnel and equipment to traverse the roof deck, has been completed.

B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness that would prevent the execution, and quality of application, or the roofing system as specified. Do not proceed with application of the roofing system until all defects are corrected.

3.02 PREPARATION

A. Structural Concrete Decks; Surface Preparation:

1. Inspect concrete decks closely for smoothness, cracks over 1/8 inch, spalling, rust staining, excessive deflection, and moisture. Perform the manufacturer's dryness test to ensure that the deck is ready to receive the roofing system and that application medium bonds well to the surface.

2. Unacceptable areas should be brought to the attention of the General Contractor and Project Architect and must be corrected prior to installation of roofing system.

3. Ensure that all wood blocking has been installed as detailed in the plans and specifications, or as required for a complete and proper project.

4. Ensure that all counterflashing, receivers, curbs, etc. are constructed in such a manner as to provide a minimum 8" base flashing height measured from the finished roof's surface to the top of the base flashing membrane.

3.03 REMOVAL

A. Remove the existing roofing and insulation down to the existing deck along with all fasteners and plates, removing only that portion that can be made watertight at the completion of the workday or before any inclement weather.

B. Verify deck is clean and smooth, free of depressions, waves, or projections. All surfaces must be clean, smooth, dry, compatible and free of dirt, debris, oil/grease and gravel. Damaged or missing decking material must have new like materials installed so as to meet the requirements of the manufacture's written instructions for application of the new roofing.

C. Do not apply roofing materials to damp, frozen, dirty, dusty, or deck surfaces unacceptable to the manufacturer.

D. Surfaces that will receive roofing shall be in a condition ready to receive the required roofing per the manufacturer's requirements.

3.04 PHASE APPLICATION

A. Phase application of the roofing membrane will not be permitted. Apply all materials to the area during the same day that it is started, including making all areas watertight. All seams are to be sealed each day.

3.05 CONDITION OF SURFACE

A. Surfaces that will receive roofing shall be in a condition ready to receive the required roofing per the manufacturer's requirements.

B. Wood Deck: Verify securement, flatness, joint spacing, and slope of wood decking.

1. Replace damaged or defective areas prior to commencement of work under this section.

2. Seal joints of plywood with tape.

3. Fill knots with latex filler.

C. Clean the substrate of projections and substances detrimental to the work.

D. Install cant strips and similar accessories as shown and as recommended by the roofing systems manufacturer even though not shown.

1. Install wood nailers at the perimeter of the entire roof and around penetrations as indicated.

a. Anchor nailers to roof deck in accordance with Article 3.07, G, H and I.

E. Prime the substrate if recommended by roofing system manufacturer; comply with manufacturer's recommendations.

1. Prime the entire surface with the manufacturers Concrete Primer.

F. Coordinate roofing with flashings and other adjoining work to insure proper sequencing of the entire work.

G. Metal Deck: Verify securement and slope of metal decking.

1. Replace damaged or defective areas prior to commencement of work under this section.

2. Verify flutes of steel deck are clean and dry.

H. Concrete Decks:

1. Verify slope and condition of concrete decking.

2. Ensure flatness and verify tight joints of concrete deck.

3. Verify adjacent precast concrete roof members. Do not vary more than 1/4 inch in height. Verify grout keys are filled solid.

3.06 PREPARATION

A. No trace of surface water shall be present. Materials under roofing shall be completely dry. Sweep surface clean of dust, debris, and loose and foreign materials.

B. Start of application of roofing signifies acceptance of existing conditions.

3.07 WOOD BLOCKING, CANTS AND PLYWOOD

A. Wood blocking is required, as indicated in the details and drawings, and as required by existing field conditions, whether specifically detailed or not.

B. Provide new treated wood blocking where existing wood blocking that is not indicated to be removed is deteriorated.

C. Provide treated wood blocking at perimeter of roofing membrane, all sides of penetrations by roof accessories, mechanical curbs, and other areas where blocking is required by membrane manufacturer to nail membrane and flashing in place.

D. Blocking Thickness: Equal to thickness of insulation. (1/2 Inch).

E. Provide wood blocking to raise existing equipment curbs flashing heights; maintain 8 inches minimum height above membrane, or as required to obtain membrane roofing system manufacturer's 20-Year No Dollar Limit Warranty.

F. Provide wood blocking, and plywood at locations indicated.

G. In all areas where nailers are required, they shall be firmly anchored to the deck to resist a minimum force of 200 lbs. /lineal foot (2.9 kN/m) in any direction. A ½" (15 mm) of each end. Spacing and fastener embedment shall conform to FM Global Loss Prevention Data Sheet 1-49.

H. Secure wood blocking to wood blocking with 16d nails at 6 inches on center. Stagger nails on each side of blocking.

I. All woodwork to be reused shall resist a minimum force of 200 lbs. /lineal foot (2.9 kN/m) in any direction and shall be free of rot. If any existing woodwork is questionable, it shall be removed and replaced with suitable new materials.

3.08 INSTALLATION OF GYPSUM SUBSTRATE BOARD TO STEEL AND WOOD DECKS

A. Install the Substrate Gypsum board as per the manufactures written instructions but with not less than 16 fasteners per 4'x8' board on steel decks.

3.09 INSTALLATION OF VAPOR BARRIER ON STEEL AND WOOD DECKS

A. SA Primer is to be mixed well before use. Do not thin. Apply with roller or spray can. Apply uniformly with no streaks or puddles. Allow to dry completely. Primer should be tacky but should not transfer to a clean dry finger.

B. Apply SA Primer (low VOC) to top/exposed surface of the gypsum substrate board.

C. Roll out Vapor Barrier SA membrane over the areas that have received the SA Primer Low VOC. Be sure to stagger the end laps and overlap the side laps by a minimum of 3". Once the membrane is in the desired location, hold the membrane tight while peeling away the silicone release liner at an angle. Install additional rolls in the same way, with 3" side laps and 6" end laps. A minimum 75 pound split linoleum roller should be used over the entire surface and a 4" rubber roller should be used in the overlap areas.

3.10 INSTALLATION OF THE VAPOR BARRIER ON CONCRETE DECKS.

A. Prime the concrete deck with:

1. JM Concrete Primer at the rate of 1 gallon per 100 sq. ft. Allow primer to dry thoroughly.

2. Carlisle CAV-GRIP III Primer Apply CAV-GRIP III in an even coat to substrate keeping the spray tip approximately 12" (30.5 cm) away and perpendicular to the surface during spray.

B. Thermally fuse as per the manufacturer's recommendation and details the SBS Vapor Barrier to the primed concrete deck lapping end laps 6 inches and side laps 3 inches.

3.11 INSULATION AND COVER BOARD INSTALLATION

A. Adhered Insulation: Install each layer of maximum 4'x4' insulation and cover board and adhere to substrate as follows:

B. Starting at the low edge of the roof, install thermal layer and thermal protective layer in specified urethane adhesive.

C. Install boards with long joints continuous.

D. Stagger all joints from the board below.

E. Butt joints tightly.

F. "Occasional" joint widths up to 1/8" will be allowed. Fill all any widths greater than 1/8" with scrap thermal layer to achieve consistent surface.

G. Set thermal layer in a serpentine fashion using two-part urethane insulation adhesive applied in 3/4 inch wide beads at the following minimum rates:

1. Field: Beads at **4** inches on center
2. Perimeter: Beads at **4** inches on center
3. Corner: Beads at **4** inches on center

H. Place board into the adhesive while it is still tacky.

1. If adhesive reaches its tack-free state, remove and re-apply adhesive.

I. Press the thermal layer into the adhesive to a firm and uniform bearing.

1. Use ballast (sand bags or bagged rocks) on all four corners of the board for a minimum of 30 minutes to ensure contact of material and adhesive, if necessary.

J. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.

K. Install only as much insulation as can be covered with roofing membrane the same day.

L. Repair any defects or installation errors prior to next phase of roof system installation.

3.12 INSTALLATION OF SINGLE PLY EPDM SHEET MEMBRANE

A. At the end of each day's work, protect the installed roofing and insulation by closing off edges of the system with water cut-off.

1. Remove water cut-off sealants completely and clean prior to resuming roofing application.

B. Position roofing membrane without stretching. Allow membrane to relax for approximately 30 minutes to one hour before fastening, splicing or securing membrane.

C. Adhered EPDM; starting at low edge, install EPDM membrane to properly prepared substrate following manufacturer's instructions for complete installation of a fully adhered membrane.

1. Begin by applying the sheets shingle fashion with all side laps perpendicular to the slope. Offset end laps a minimum of three (3) feet. Ensure the membranes overlap sufficiently to permit a six (6) inch lap. Position sheets so that lap seams are not "bucking" water. Fold sheet back one-half its width. Fold so that there are no wrinkles or buckles.

2. With a roller, evenly apply a coat of bonding adhesive to the exposed underside of the membrane and cover board. Apply adhesive evenly without puddles or globs. Do not apply bonding adhesive to splice areas. Allow the cement to dry until it is tacky, but does not string or stick when touched with a dry finger. Roll the coated membrane onto the coated substrate, avoiding wrinkling, stretching or buckling. (Remove all sheets that have wrinkles) Brush down bonded half of sheet with a good, stiff push broom or similar device to ensure a good contact, and adhesive bond. Fold back the other half of membrane, and repeat procedure for bonding. Install adjacent sheets with 4-inch lap edges.

3. At end lap areas, apply tape primer wash and allow to dry to the touch. Install seam tape over prepared bottom membrane. Roll the top EPDM sheet onto the seam tape, with the release paper still in place. Remove the seam tape by peeling it back parallel to the roof surface and away from the splice at a 45-degree angle.

4. Tape-to-Tape Installation: Align membrane for appropriate overlap, remove release liners and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation.

5. Hand-roll the seam: First, roll perpendicular across the entire splice and toward the outside edge. Then, roll along the length of the splice.
Note: Extend membrane over roof edges, covering the full height of wood blocking. Secure in place on face of blocking.

Install cant dam over top of membrane. Set cant dam in full bead of sealant mastic.

3.13 MEMBRANE SPLICING IN-SEAM TAPE

A. Fold un-bonded membrane back. Fold so that there are no wrinkles.

B. Clean both mating surfaces using clean fiber rags or natural sponges. Clean with primer/ wash cleaning agents approved by the roof manufacturer.

C. Roll 6-inch seam tape in a straight line at lap area. Peel off paper as roll progresses along seam line. In-seam tape not to exceed ¼-inch exposure along edge.

D. Roll the top membrane onto the adhesive, avoiding wrinkles and buckles.

E. Roll splice with 2-inch steel roller, using pressure toward the outer edge of the splice.

F. Clean the splice edge with cleaning agent approved by manufacturer.

G. Provide polyester reinforced termination strips at base of vertical surfaces, such as curbs, walls, roof hatches, skylights and roof top equipment.

3.14 LAP-SEAM COVER TAPE WHERE REQUIRED

A. Clean surfaces of membrane at areas of field seams with cleaning agent approved by manufacturer.

B. Install 6-inch wide self-adhering tape with roller using pressure toward the outer edge.

3.15 FLASHING

A. Preparation: Inspect all walls, curb heights, counterflashings, etc. and check for conformance with minimum base flashing height of eight (8) inches. Correct any non-conforming areas prior to installation of flashing.

B. Follow same procedures as described for cleaning, adhesive application, and lap sealant application.

C. EPDM Flashing Materials:

1. Install cured EPDM membranes for flashing of all straight walls, large curbs, and all large straight-sided penetrations.

2. Install uncured EPDM flashing or uncured EPDM Peel & Stick Flashing for flashing of all pourable sealer penetration pockets, vent pipes, scuppers, curbs, T-joints and inside/outside corners of wall flashings.

D. Primer: Prime all metal with tape primer/wash. Allow the primer to dry thoroughly.

E. Installation: Install reinforced termination strip per manufacturer’s published details to secure field sheet at all walls and curbed penetrations. Adhere all EPDM Flashing membranes to any horizontal or vertical substrates with EPDM Bonding Cement.

1. Apply EPDM Bonding Cement evenly with a roller to flashing membrane and substrate. Allow to dry to tacky, so adhesive does not string when touched.

2. Roll the membrane into the substrate to avoid wrinkling or stretching. Take care to ensure that the flashing does not bridge at any change of plane such as the transition from the roof deck to a parapet wall.

3. Secure terminations utilizing aluminum compression bars or surface-mounted counterflashings directly to a smooth-sealed wall surface.

4. Fully extend flashings terminated with metal copings under the coping and mechanically fasten at a minimum of 1-1/2” down the face of the wall.
5. Flash all pipes with peel and stick flashing boots or an approved field flashing (as detailed in the manufacturer’s specifications).

6. Install field sheet up and over wood blocking at all fascia or coping areas fastening the sheet on the outside face of the wood blocking.

7. At vertical surfaces apply EPDM flashing over polyester-reinforced termination strip. Extend flashing 4-inch minimum onto the roof surface and full height of curbs and vertically up walls a minimum of 12 inches unless indicated otherwise. Remove roof top equipment to extend flashing over the top of the curbs. Provide deck overlayment on vertical surfaces.

8. Remove roof top power ventilators, extend top of curb to minimum 12 inches above roofline. Extend flashing over top of curb. Reset equipment.

9. Provide termination strip and continuous bead of sealant under counter flashing.

10. Straight run wall and curb flashings shall be flashed with EPDM membrane. **Note: All flashings are to extend a minimum height of 8" (200mm) above the roof level.**

11. On all re-roofing applications, loose flashing materials must be removed down to a sound substrate and replaced with new flashing. To ensure proper drainage of the existing structure, weep holes must never be covered by new flashings.

12. Terminations utilizing aluminum compression bars are surface-mounted counter-flashings must be secured directly to a smooth and sealed wall surface.

13. EPDM wall flashings terminated with metal copings must be fully extended under the coping and mechanically fastened to a minimum 1 ½" (40mm) down the face of the wall.

14. EPDM Flashing Membrane shall be adhered to substrate using EPDM bonding cement. Follow the EPDM adhered instructions for correct application of this cement. The flashing membrane shall be rolled carefully into the substrate. Care must be taken to ensure that the flashing does not bridge at any change of direction, such as from the base of a parapet wall to the roof deck.

3.16 INSTALLING ROOF EDGING SYSTEM

A. Inspection: Verify that the roof edging installation will not disrupt other trades. Verify that the substrate is dry, clean and free of foreign matter. Report and correct any defects prior to any installations.

B. Installation of Roof Edging System: Submit product design drawings for review and approval to the Architect before fabrication.

C. The Contractor is fully responsible to check all as-built conditions and verify the manufacturer's roof edge details for accuracy to fit the wall assembly prior to fabrication. **Contractor's Note: Submitted roof edge details will accurately depict existing conditions and will be supplied to resolve existing conditions at no additional cost to the Owner**.

D. Comply with the roof edging manufacturer's installation guide when setting the roof edging.

E. Use provided fasteners consistent with the manufacturer's instructions, suitable for the substrate to which it is being installed.

F. Install water cut-off, as recommended by the membrane manufacturer, under the anchor bar.

G. Roof Edge Flashing Strips: Install all flashing strips in longest lengths possible to minimize laps under the anchor bar. Following the manufacturer's application method for flashing, install the strips:

1. Minimum 8 inches into the field of the roof;
2. Down the outside face of the wall, ½ inch past wood nailers.

H. Miter & Scupper Bar: Remove all dirt, dust and debris from the anchor bar. Apply a 3-inch wide and ¼-inch thick band of mastic to the back of the anchor bar.

I. Splice Plates: Apply a 3/8 inch bead of non-curing sealant to both sides of the spacer and on the deck flange.

J. Anchor Bar: Position 12-foot long sections of anchor bar with applied mastic overlapping splice plate and butting securely to the EPDM gasket.

1. Allow ½ inch space between anchor bars.
2. Install splice plate at opposite end of 12-foot long anchor bar.

Fasten anchor bar at 12 inches on center intervals through. Use 2” stainless steel fasteners as provided by the manufacturer. Field cut sections as necessary.

K. Fascia Panels: Install panels left to right. Position 12’ fascia panels on top of the anchor bar. Overlap preceding panel by 1 inch at notches provided. With panels in correct position, snap each section into anchor panel.

3.17 WALKWAY PADS

A. Provide manufacturer’s standard EPDM walkway pad under each ladder, roof hatch, completely around each HVAC unit, and to any other areas designated on the drawings. Install in accordance with manufacturer’s requirements with lap cement or seam tape.

3.18 EXPANSION JOINT

A. Install a new expansion joint cover, curb to wall, curbed formed as per the manufacturers’ specifications.

3.19 WATERSTOPS

A. Install temporary cutoffs around incomplete edges of roofing assembly at the end of each workday and when work must be postponed due to inclement weather. Straighten the insulation line using loosely laid pieces of insulation. Seal the EPDM membrane to the deck or existing membrane by performing the following procedure: Fold the edge of the roofing membrane back a minimum of 12” (300mm). Clean the surface of the folded-back membrane with EPDM Primer or other approved cleaning method. Apply a ¼” (8mm) bead of Lap Caulk or Pourable Sealer on the cleaned area of the sheet. If the roofing membrane installation is to be delayed for 14 days or more, of if the substrate surface is rough, apply two ¼” (8mm) beads of sealant. Remove the temporary seams completely when work resumes, cutting out the contaminated membrane. Remove all sealant, contaminated membrane, insulation fillers, etc. from the work area and properly dispose off-site.

3.20 ROOF DRAINS

1. New Roofs:

a. Set drain flange tight to roof deck.

b. Secure roof drain to roof deck with approved under deck clamp bolted to underside of drain body.

c. Insulate roof drain sump and horizontal piping.

d. Coordinate with types, locations, and quantities as indicated on plans.

2. Existing Roofs:

    a. The Contractor shall remove the existing Roof Drain Dome Strainers and Flashing Clamp Rings and discard.

    b. Clean and prep remaining drain bowl assembly for new roofing.

    c. Contractor to Install New Cast Iron Dome Strainers, Flashing Clamp rings and 2” Cast Iron Static Extension Ring, replace all missing or damaged components with new to match as manufactured by Zurn, or approved equal by Architect.

3. Provide a smooth transition from drain bowl to deck surface.

    a. Taper insulation back from drain a minimum of 24” to provide for positive drainage.

    b. Prime all metal surfaces.

4. Install EPDM membrane at drain bowl.

    a. Proceed with installations only after unsatisfactory conditions have been corrected.

    b. Extend membrane 1" beyond the inside edge of the drain bowl.

    c. Position membrane so as to avoid the occurrence of any seams at drains.

5. Install clamping ring and drain covers supplied with drain.

6. Test all drains for proper flow and water tightness. Correct defects.

3.21 VENT STACKS AND PENETRATIONS

A. Use pre-molded pipe boot for vent stacks.

B. Use peel and stick pipe boots for all hot pipe penetrations.

C. Use roof penetration pocket flashing with nailer and pourable sealer for all angles and unusual penetrations.

3.22 INSPECTIONS

A. After all roofing system work is completed, provide an inspection by the roofing system manufacturer’s representative. Representative must be employed expressly as a technical employee and not concurrently in a sales role. Provide, via the representative, documentation verifying that roofing system has been installed according to the Specifications.

B. All work shall also be subject to inspection by Architect and Owner. Work found to be in violation of specifications or not in accordance with established workmanship; practices and standards will be subject to complete removal and proper replacement with new materials at contractor’s expense.

3.23 CLEANING

A. Clean up and remove daily from the site all wrappings, empty containers, paper, loose particles, and other debris resulting from these operations.

B. Remove markings from finished surfaces. Restore all other building surfaces and areas affected by the roofing application to the same conditions of aforementioned on day of job start.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

D. Keep newly installed roofing membrane clean and new in appearance under the assumption that all areas of roofing are aesthetically essential. Contractor may be directed to remedy – and if no remedy available – replace, newly roofed areas that are not maintained as such during the balance of installation.

3.24 PROTECTION

A. Provide traffic ways, erect barriers, temporary interior partitions and enclosures, fences, guards, rails, enclosures, chutes, and the like to protect personnel, roofs, and structures, vehicles and utilities.

B. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8" thick.

C. In addition to the plywood listed above, an underlayment of minimum 1/2-inch recovery board is required on new roofing.

1. Special permission must be obtained from the manufacturer before any traffic will be permitted over new roofing.

3.25 FIELD CONTROL

A. Field inspection will be performed as outlined under 1.12 of this section.

3.26 TESTING OF COMPLETED ROOF SYSTEM

A. Schedule flooding of roofs with the Owner. No flood testing will be allowed when buildings are occupied. Flood each area of roofing membrane with no less than a 2” depth of water. Include all areas sloped not over ¼” per foot. Provide temporary dams where required. Leave in place 24 hours and examine substructure for evidence of leakage. Repair leaks and retest as before, until no leakage is observed.

3.27 POSITIVE DRAINAGE

A. The General Construction Contractor or the roofing contractor (if separate prime contract) shall be responsible for installing the roof slope and drainage in accordance with N.R.C.A. standards. Additionally, the Contractor shall be responsible for the installation of structural steel, roof decking, roof drains, tapered insulation, perlite, crickets, roof plies, etc. in accordance with and to the tolerances indicated in the contract documents. **There should be no standing water on any portion of the entire roof surface 48 hours after a rainfall, during ambient drying conditions.**

B. The roof manufacturer’s representative shall witness the conducting of the positive drainage exercise, and sign-off on same.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 076000 – FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Provide and install new cap, counterflashing, wall and base flashing as required for proper installation, as shown on drawings and specified herein.

B. Related Sections include the following:

1. Section 033000 – Cast-in-Place Concrete - for concrete fill and reinforcing steel.
2. Section 042000 – Unit Masonry - for work adjacent to work of this Section.
3. Section 051200 – Structural Steel Framing - for work adjacent to work of this Section.
4. Section 053000 – Metal Decking - for work adjacent to work of this Section.

1.02 DELIVERY AND STORAGE

A. Delivered materials shall be in the manufacturer's original packages and containers, clearly marked with the approved manufacturer's name and trademark for every item.

B. Store all materials in a dry, ventilated place off the ground. During adverse weather conditions and job delays, store materials under cover or in a totally enclosed space. Use of wet materials will not be permitted.

1.03 PREPARATION

A. Wood blocking and nailers for flashing cleats shall have been rigidly anchored in place.

B. Dissimilar materials in contact shall be fully isolated from each other. Unprimed, abraded, or otherwise corrosive surfaces of metal shall receive a coat of the bituminous paint, and allow to dry before assembling.

1.04 SUBMITTALS

A. Comply with requirements of Section 013000 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit manufacturer's product specifications, installation instructions, and general recommendations for each specified sheet metal material and fabricated product.

C. Samples:

1. Submit two 8" square samples of specified sheet materials to be exposed as finished surfaces.

2. Submit two 12" long completely finished units of specified fabricated products exposed as finished work.

D. Shop Drawings:

1. Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter flashings, trim/fascia units.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum: ASTM B209, .032" thick aluminum alloy 3003-H14.

B. Copper: ASTM B370, 16 oz. and 20 oz. soft temper. Copper exposed to weather shall be lead coated as per ASTM B101. Class "A".

C. Solder: As recommended by the copper manufacturer. Conform to ASTM B32 - min. tin content for lead coated copper 60 percent.

D. Stainless Steel: Sheets or strips - ASTM A240 or ASTM A666, Type 302 or 304 gauge. .015 inch - 8-to-10-foot lengths. Finish - 2D. Solder - ASTM B32 - 60-40% block tin and piglead. Flux - Acid type. Sealant - single component synthetic rubber - color as selected by Architect.

E. Nails: For copper work, 3/8" diameter head, solid copper.

F. Pop Rivets: Noncorrosive metal, may be used where watertightness of fastener is not a factor or if waterproof rivets are used.

G. Standard of Workmanship: Methods of forming and joining copper shall be as specified and detailed in the booklet "Copper and Common Sense", published by Revere Copper and Brass Incorporated, except as modified herein and suggested guide specifications for "Stainless Steel Roofing and Flashing" published by International Nickel Company, Inc.

H. Pipe Flashing: Flashing around pipes and vents extending above the roof shall consist of copper stainless zinc tubes of proper diameter, extending at least 12" above the finished roof surface, and extending at least 6" beyond opening.

I. Mechanical Equipment Flashing: Examine plans and specifications for mechanical and electrical trades and note extent of flashing covered herein. Provide all flashing in addition thereto as necessary.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The installer shall examine the substrate and the conditions under which flashing work is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 PREPARATION

A. Coordination:

1. Coordinate flashing work with other work for correct sequencing of items making up entire system of waterproofing and rain drainage.

2. Do not proceed with the installation of flashing work until curb and substrate construction, cant strips, blocking, reglets, and other construction to receive the work are complete.

3.03 INSTALLATION

A. Comply with manufacturer's instructions for handling and installation of flashing work.

1. Unless otherwise recommended by manufacturer, comply with recommendations of NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" for items shown on drawings.

2. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook" Conform to dimensions and profiles shown unless more stringent requirements are noted on the drawings.

3. Comply with details and profiles shown on drawings.

B. For non-moving seams, provide soldered flat lock seams, except as otherwise indicated. Comply with metal producer's recommendations for tinning, soldering, and cleaning the joints.

1. Flashing and trim: 10'-0" maximum spacing, and 2'-0" from corners and intersections.

2. Conceal fasteners and expansion provisions wherever possible. Fold back edges on concealed side of exposed edges to form a hem.

3. Insert flashings into reglets where shown. Anchor by mechanical means, including driven wedges of lead or other compatible metal, space 2'-0". Seal the joint with sealant as indicated.

4. Separate copper work from dissimilar metals by a 15 mil dry film thickness bituminous coating or by a heavy tinning of solder at spot contacts.

5. Fabricate, support, and anchor rain drainage in a manner which will withstand thermal expansion stresses and full loading by water or ice, without damage, deterioration, or leakage.

6. On bituminous membranes, provide not less than 4" embedment of flashing in membrane, and cover edge with tape or stripping set in roofing cement.

3.04 MISCELLANEOUS WORK AND CLEANING

A. Do all necessary cutting, patching fitting in connection with the flashing work required to coordinate this work with that of other trades.

B. On completion, flashing work shall be left in perfect condition. Neutralize excess flux which may cause acid stains in washing soda.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 076219 – FABRICATED GRAVEL STOPS AND FASCIA

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Provide and install new metal fascia, coping, gravel stop, drip edge, and coping cap as required for installation of new roof cover as specified in the roofing section and as shown on Drawings.

1.02 RELATED SECTIONS

A. Section 061000 – Rough Carpentry
B. Section 072100 – Building Insulation
C. Section 074213 – Metal Wall Panels
D. Section 074293 – Metal Fascia and Soffit Panels
E. Various Division 07 Roofing Specifications

1.03 REFERENCES

A. ANSI/SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
B. Florida Building Code, including the High Velocity Hurricane Zone
C. Miami-Dade County NOA No. 03-0108.06
D. Factory Mutual Research Corporation Approval Guide
E. SPRI Single Ply Roofing Industry Standards

1.04 SUBMITTALS

A. Comply with requirements of Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Show profiles, joining method, location of accessory items, anchorage and flashing details, adjacent construction interface, and dimensions.

D. Selection Samples: For each finish product specified, two complete sets of color charts representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two sample chips representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Edge Securement and Design Criteria:

1. ANSI/SPRI Wind Design Standard for Edge Systems used in Low Slope Roofs – all roof edge systems shall comply with the requirements of ANSI/SPRI System Requirements ES-1 2003 Wind Design Standards Test RE-3.

2. The Contractor shall supply written confirmation of this compliance stating that the roof edge system materials:

    a. Exceed 75 lbs./lf outward load in conformance with ANSI/SPRI ES-1 2003 Wind Design Standards Test Method RE-3; and
    b. Exceed 120 lbs./lf outward load in conformance with ANSI/SPRI ES-1 2003 Wind Design Standards Test Method RE-3.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section with minimum twenty five years documented experience.

B. Installer Qualifications: Company specializing in the installation of products specified in this section with minimum five years documented experience.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store materials in a dry, protected, well-vented area.

C. Remove protective plastic surface film immediately before installation.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. Provide the manufacturer's warranty specified under products for the roof edge system, when installed per manufacturer's instructions. Warranty will not exceed the life of the roof membrane on which the product was originally installed.

B. Provide a 30 year warranty for manufacturer approved 70 percent Kynar colors for the painted finish covering color fade, chalk, and film integrity.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Metal Era, Inc., which is located at: 1600 Airport Rd.; Waukesha, WI

53188; Toll Free Tel: 800-558-2162; Tel: 262-549-6900; Fax: 800-373-9156; Email: request info (info@metalera.com); Web: www.metalera.com

2.02 ROOF EDGE PRODUCTS

A. Anchor-Tite Standard Fascia: Decorative metal fascia with continuous extruded aluminum bar.

1. Construction:

a. Fascia metal gauge:

1) .040 inch thick formed aluminum.
2) 24 gauge galvanized steel.

b. Aluminum Finish:

1) Standard color Kynar-500 as selected by the Architect from roof edge manufacturer's color chart or custom Kynar-500 color as selected by the Architect.

c. Fascia: Standard 12 feet 0 inches lengths.

d. Extruded bar: Shall be continuous 6063-T6 alloy aluminum at 12 feet 0 inches standard lengths with pre-punched slotted holes. All bar miters are welded.

1) Injection Molded EPDM Bar Splice to allow thermal movement expansion of extruded aluminum anchor bar.
2) Fasteners: 2 inch stainless steel with driver.

2. Fully Adhered or Mechanically Attached Single-Ply Version

a. Model:

1) AF-55 or as indicated on the drawings.

b. Performance:

1) Lifetime, 215 mph Wind Warranty.
2) Tested per ANSI/SPRI ES-1 Standard to a design pressure of 290 lbs./ft2to comply with the International Building Code.
3) Factory Mutual 1-645 approved for wind up lift protection.
4) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity Hurricane Zone of the Florida Building Code”.

3. Built-Up or Modified Version

a. Model:

1) AFM-55 or as indicated on the drawings.

b. Performance:

1) Lifetime, 215 mph Wind Warranty.
2) Tested per ANSI/SPRI ES-1 Standard to a design pressure of 290 lbs./ft2to comply with the International Building Code.
3) Factory Mutual 1-645 approved for wind up lift protection.
4) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity

Hurricane Zone of the Florida Building Code".

B. Anchor-Tite Extended Fascia: A three-part assembly consisting of a continuous extruded aluminum bar, exterior fascia and continuous formed galvanized steel cleat with fasteners.

1. Construction:

a. Fascia Metal:

1) 063 inch thick-formed aluminum.

b. Aluminum Finish:

1) Standard color Kynar-500 as selected by the Architect from roof edge manufacturer's color chart or custom Kynar-500 color as selected by the Architect.

c. Fascia: standard 12 feet 0 inches lengths with matching concealed joint splice plates.

d. Extruded bar: Shall be continuous 6063-T6 alloy aluminum at 12 feet 0 inches (3.65 m) standard lengths with pre-punched slotted holes. All bar miters are welded.

1) Injection Molded EPDM Bar Splice to allow thermal movement expansion of extruded aluminum anchor bar.
2) Fasteners: 2 inch stainless steel and 1/4 inch by 1-1/4 inch masonry/wood with driver.

e. Anchor Bar Cleat: Standard 12 feet 0 inches lengths of commercial type 20 gauge G-90 galvanized steel with pre-punched holes.

2. Fully Adhered or Mechanically Attached Single-Ply Version

a. Model:

1) AEF-100 or as indicated on the drawings.

b. Performance:

1) Lifetime, 215 mph Wind Warranty.
2) Tested per ANSI/SPRI ES-1 Standard to a design pressure of 190 lbs./ft2to comply with the International Building Code.
3) Factory Mutual 1-270 approved for wind up lift protection.
4) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity Hurricane Zone of the Florida Building Code".

3. Built-Up or Modified Version

a. Model:

1) AEFM-100 or as indicated on the drawings.

b. Performance:

1) Lifetime, 215 mph Wind Warranty.
2) Tested per ANSI/SPRI ES-1 Standard to a design pressure of 190 lbs./ft2to comply with the International Building Code.
3) Factory Mutual 1-270 approved for wind up lift protection.
4) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity

Hurricane Zone of the Florida Building Code”.

C. Anchor-Tite Canted Fascia: Three-part assembly consisting of a continuous extruded aluminum bar, exterior fascia and continuous formed galvanized steel cleat with fasteners.

1. Construction:

a. Fascia Metal:

1) 063 inch thick-formed aluminum.

b. Aluminum Finish:

1) Standard color Kynar-500 as selected by the Architect from roof edge manufacturer's color chart or custom Kynar-500 color as selected by the Architect.

c. Fascia: standard 12 feet 0 inches lengths with matching concealed joint splice plates.

d. Extruded bar: Shall be continuous 6063-T6 alloy aluminum at 12 feet 0 inches (3.65 m) standard lengths with pre-punched slotted holes. All bar miters are welded.

1) Injection Molded EPDM Bar Splice to allow thermal movement expansion of extruded aluminum anchor bar.
2) Fasteners: 2 inch stainless steel and 1/4 inch by 1-1/4 inch masonry/wood with driver.

e. Waterdam: Standard 12 feet 0 inches lengths of commercial type 24 gauge G-90 galvanized steel with pre-punched slotted holes.

f. Anchor Bar Cleat: Standard 12 feet 0 inches lengths of commercial type 20 gauge G-90 galvanized steel with pre-punched holes.

2. Galvanized Waterdam Version.

a. Model:

1) AEFC-1052 or as indicated on the drawings.

b. Performance:

1) Lifetime, 215 mph Wind Warranty.
2) Tested per ANSI/SPRI ES-1 Standard to a design pressure of 190 lbs./ft2to comply with the International Building Code.
3) Factory Mutual 1-270 approved for wind up lift protection.
4) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity Hurricane Zone of the Florida Building Code”.

D. Perma-Tite Continuous Cleat Coping.

1. Construction:

a. Fascia Metal:

1) 063 inch aluminum.

b. Aluminum Finish:

1) Standard color Kynar-500 as selected by the Architect from roof edge manufacturer's color chart or custom Kynar-500 color as selected by the Architect.

c. Construction:

1) Coping cap: length of 12 feet 0 inches, widths to 24 inch manufactured to job requirements. True radii may be built to template.
2) Coping vertical face and back leg: 2-1/4 inch to 12-1/2 inch manufactured to job requirements.
3) Concealed splice plates: 8 inch wide. Finish to match finish of coping cap with factory applied dual non-curing sealant strips.
4) Continuous Cleat: 20 gauge pre-punched galvanized cleat with stainless steel spring mechanically locked to cleat normally 12 inch wide at 4 foot 0 inch on center. Mechanically fastened as indicated and detailed.

d. Fasteners: 1-1/2 inch Stainless Steel with driver

2. Tapered Version

a. Performance:

1) 20 Year, 110 mph Wind Warranty.
2) Tested per ANSI/SPRI ES-1 Standard to comply with the International Building Code.
3) Factory Mutual 1-90 approved for wind up lift protection.
4) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity Hurricane Zone of the Florida Building Code".

2.03 ACCESSORIES

A. Miters and end caps shall be fabricated by manufacturer to suit the conditions indicated on the Drawings.

B. Provide fasteners consistent with manufacturer's instructions for each product that is suitable for the substrate to which it is being installed.

C. Provide Fascia Extenders with offset with continuous cleat where necessary to cover wood blocking.

D. For metal work, provide the type solder recommended by the producer of the metal sheets for fabrication and installation. All fastenings shall be done with stainless steel screws (type as approved by the Architect).

E. Roofing cement: ASTM D-2822, asphaltic.

F. Bituminous coating: FS TT-C-494, or SSPC Paint 12, solvent-type bituminous mastic, compounded for 15 mil dry film thickness coating.

G. Reglets: Metal or plastic units of the type and profile indicated; compatible with flashing indicated; non-corrosive.

H. Metal accessories: Provide sheet metal clips, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The installer shall examine the substrate and the conditions under which gravel stop and fascia work is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

B. Verify that the substrate is dry, clean and free of foreign matter.

C. Verify the manufacturer's roof edge details for accuracy to fit the assembly prior to fabrication.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Verify the manufacturer's roof edge details for accuracy to fit the assembly prior to fabrication.

3.03 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

1. Comply with details and profiles shown on drawings.

B. Use provided fasteners consistent with manufacturer's instructions, suitable for the substrate to which it is being installed.

C. Install water cut-off, as recommended by the membrane manufacturer, under the anchor bar.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 GUARANTEE/WARRANTY

A. In addition to the Contractor's guarantee, the Contractor shall furnish the Owner a twenty (20) year limited warranty from the manufacturer against failure of finish for all metal copings and gravel stops.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 077000 – ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Provide labor, materials, and equipment necessary for complete installation of flashing and sheet metal work, including manufactured systems. Work under this Section includes, but is not limited to:

1. Prefabricated cornices, mouldings, gutters and downspouts.
2. Sealants and bonding agents between components of this Section and between the roof and other materials.

B. Roof specialties and accessories of the following types:

1. Cornices.
2. Mouldings.
3. Designer Series commercial gutters.
4. Industrial Series gutters.
5. Drain ware.

C. Related Work Specified Elsewhere

1. Section 076000 – Flashing and Sheet Metal.
2. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
3. Curbs for roof mounted heating and ventilating equipment are included in the Work of Division 23.

D. General: Accessories and items essential for the completeness of the sheet metal installation. Such items, unless otherwise shown on the Drawings or specified, shall be the same kind of material as the item to which applied. Nails, screws, and bolts shall be of the types suited for the purpose intended, and shall be compatible with the metal to which it will contact.

E. Forming and assembling of sheet metal components shall be performed using methods that will not void the manufacturer's 20 year finish warranty.

F. Refer to Section 012300 for Alternates that may affect the Work of this Section.

1.02 RELATED SECTIONS

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Related Sections include the following:

1. Section 061000 – Rough Carpentry
2. Section 076000 – Flashing and Sheet Metal
3. Section 079200 – Joint Sealants

1.03 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Procedures.

B. Product Data: Submit manufacturer's detailed product data showing dimensions of individual components, profiles, and finishes, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Fully dimensioned roof plans, reflective plan views, dimensioned framing requirements, sections and details of components and other related trims.

D. Selection Samples: For each finish product specified, manufacturer's technical data for specified finish and color chart showing full range of colors available.

E. Verification Samples: For each finish product specified, manufacturer's technical data for specified finish and two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. LEED Submittals: (when applicable)

1. Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 “LEED Requirements”.

1.04 SUBMITTALS

A. Product data, flashing, sheet metal, and accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

B. Samples of the following flashing, sheet metal and accessory items:
8 inch square samples of specified sheet materials to be exposed as finished surfaces.

C. 12 inch long samples of factory fabricated products exposed as finish work. Provide complete with specified factory finish.

D. Shop drawings showing layout, profiles, methods of joining, and anchorage details, and expansion joint systems.

E. LEED Submittals:

1. Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 “LEED Requirements”.

1.05 QUALITY ASSURANCE

A. General: Provide manufactured roof specialties capable of withstanding wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Except as otherwise indicated, the workmanship of sheet metal work, method for forming joints, anchoring, cleating and provisions for expansion shall conform to the standard details and recommendations of the Copper Development Association and the "Architectural Sheet Metal Manual" published by SMACNA; and workmanship shall be of the best quality, in accordance with best trade practice and the recommendations and specifications of the Sheet Metal and Air

Conditioning Contractors National Association, Inc.

C. Provide manufactured roofing specialties, incorporating roof edge treatment that complies with recommendation of FM Loss Prevention Data Sheet 1-49 for the following Wind Zone:

Wind Zone 1: Wind pressures of 21 to 30 lbf/sq. ft.

D. Where pre-engineered manufactured systems are specified, other field fabricated or shop/field fabricated substitutions will not be accepted. However, where shop/field fabrications are indicated pre-engineered systems will be considered with Architect approval.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. All products delivered shall be stored in a clean dry location prior to installation.

C. Products furnished with strippable protective masking shall not be exposed to direct sunlight for more than 30 minutes without removing masking.

D. Inspect material before installation. Do not install finished materials with scars or abrasions.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best possible weather resistance and protection of materials and finishes against damage.

B. Do not install cornice and decorative trims during inclement weather. When installing in cold climates warm sealant to at least 50 degrees F (10 degrees C) prior to application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: SAF, which is located at: 14100 Veterans Memorial Hwy.; Villa Rica, GA 30180; Toll Free Tel: 800-334-9823; Tel: 678-715-3811; Fax: 770-942-4173; Email: request info (cmf@saf.com); Web: https://www.saf.com/perimeter-systems/. Subject to compliance with requirements, manufacturers offering comparable products may be incorporated into the Work include, but are not limited to the following:

Architectural Products Co.
ATAS International, Inc.
Merchant and Evans, Inc.
MM Systems Corp.

2.02 MATERIALS

A. The type and locations of the various kinds, gauges, thickness, and finish of sheet metal to be used is specified hereinafter under the individual items. Where sheet metal is indicated on Drawings and kind or type of metal is not definitely specified, aluminum shall be provided.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for use intended and as required for proper application of finish indicated, but not less than the strength and durability properties specified in ASTM B221 for 6063-T5.

C. Aluminum Sheet: Alloy and temper recommended by manufacturer for use intended and as required for proper application of finish indicated, but with not less than the strength and durability properties specified in ASTM B209 for 5005-H15.

2.03 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: Shall conform to ASTM B32-66T. Composition shall contain 50 percent tin and 50 percent lead, except as specified otherwise. Solder for aluminum and monel shall be of composition as recommended by the metal manufacturer.

B. Flux: Use resin type flux for pre-tinned surfaces.

C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

D. Bituminous Coating: SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, nondrying, non-migrating sealant.

F. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Specification Section 079200 – Joint Sealants.

G. Epoxy Seam Sealer: 2 part non-corrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

2.04 CORNICES

A. Provide cornice system with decorative trims as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. as detailed on the drawings.

B. Material: Decorative cornice profiles shall be manufactured from 0.040 inch aluminum, 10 feet lengths.

C. Fabrication:

1. Profiles containing radius bends shall be press formed with radius dies on a CNC Press to provide repeated true and accurate profiles.
2. Cornice trims shall be factory punched with elongated fastening holes.
3. Decorative cornice splices shall be manufactured from 0.040 inch aluminum, 6 inches lengths, formed to fit the inside of the cornice profiles.

4. Support brackets, attachments brackets and retainer brackets shall be manufactured from 0.125 inch by 1.0 inch extruded aluminum bar, helliarc welded construction (where necessary), factory punched for fasteners.
5. Provide factory mitered corners, precision saw cut, helliarc tack welded to produce a picture frame joint.

D. Trim:

1. Mitered Corners: Provide factory mitered corners for all cornice profiles (excluding soffits). Cornice profiles shall be precision saw cut, helliarc tack welded to produce a picture frame joint.
2. Sculptured End Caps: Provide factory mitered end caps for cornice. Cornice profiles shall be precision saw cut, heliarc tack welded to produce a picture frame joint.
3. Cornice Returns: If shown on drawings, provide cornice returns at eaves and rake terminations in lengths as indicated on plans.
4. Rake and Gable Trims: As shown on drawings, provide rake and gable trims in profiles as indicated complete with concealed splices, attachment brackets (if required).

E. Finish:

1. Apply coatings to exposed aluminum components after fabrication for maximum coating performance and to prevent crazing, abrasion, and damage to finished surfaces.
2. Pretreatment: Aluminum components shall be pretreated with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by a chrome phosphate conversion coating to which organic coatings will firmly adhere.
3. Coating Type: High Performance Coating, two-coat, shop applied, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem, Inc. Kynar 500 or Ausimont U.S.A., Inc. Hylar 5000 resin, meeting AAMA 2605 specification.
4. Color: As selected by Architect from manufacturer's offered colors or custom color selected by Architect.

2.05 MOULDINGS

A. Provide moulding as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. as detailed on the drawings.

B. Moulding types:

1. Roman Mouldings
2. Colonial Mouldings
3. Crown Mouldings
4. Convex and Concave Mouldings
5. LZ Mouldings.
6. Frieze and Architrave Mouldings

C. Finish:

1. Apply coatings to exposed aluminum components after fabrication for maximum coating performance and to prevent crazing, abrasion, and damage to finished surfaces.
2. Pretreatment: Aluminum components shall be pretreated with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by a chrome phosphate conversion coating to which organic coatings will firmly adhere.
3. Coating Type: High Performance Coating, two-coat, shop applied, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem, Inc. Kynar 500 or Ausimont U.S.A., Inc. Hylar 5000 resin, meeting AAMA 2605 specification.
4. Color: As selected by Architect from manufacturer's offered colors or custom color selected by

Architect.

2.06 DESIGNER SERIES COMMERCIAL GUTTERS

A. Provide designer series commercial gutters as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. size, configuration as detailed on the drawings.

1. Material: 0.063 inch Aluminum

B. Profile types:

1. Roman Profile - DSR Series.
2. Colonial Profile - DSC Series.
3. Batten Profile - DSB Series.
4. Contemporary Profile - DSCT Series.

C. Drain Receiver and Nozzle:

1. Size as indicated on drawings.

D. Leaf Guard Screen: Manufacturer' standard components.

E. Fabrication:

1. Concealed Gutter Liner shall be manufactured from 0.040 inch mill finished aluminum in 10 feet lengths. Liner shall be:

   a. Factory notched to receive brackets and straps.
   b. Manufactured with 1 inch telescoping and notched end laps.
   c. Factory punched with fastening holes elongated to allow for thermal movement.

2. Support Bracket and retainer stem shall be manufactured from 0.125 inch by 1.0 inch extruded aluminum bar, heliarc welded construction, factory punched for fasteners.

3. Interior Straps shall be manufactured from 0.125 inch by 1.0 inch extruded aluminum.

4. Snap-on fascia shall be manufactured from aluminum, 10 feet lengths. Fascia shall be press formed with radius dies on a CNC Press to provide repeated true and accurate profiles.

5. Fascia splices shall be manufactured from 0.040 inch aluminum, 6 inches lengths, formed to fit the inside of the snap-on fascia.

6. Corners shall be factory mitered corners for both fascia and liner. Fascia profiles shall be precision saw cut, heliarc tack welded to produce a picture frame joint. Concealed liner miter shall be precision saw cut with a continuous heliarc weld watertight joint.

7. Sculptured end caps shall be factory mitered end caps for fascias. Fascia profiles shall be precision saw cut, heliarc tack welded to produce a picture frame joint.

8. Cornice returns, if shown on drawings, shall be provided at gutter terminations in lengths as indicated on plans.

9. Liner end caps shall be provided of mill finished aluminum at all fascia end caps and wall abutments.

10. Liner expansion Joint, provide manufacturer's elastomeric expansion joints at 40 feet intervals or as shown on shop drawings.

2.07 INDUSTRIAL SERIES GUTTERS

A. Provide industrial series gutters as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. as detailed on the drawings.

1. Size: 6” min. or as indicated on drawings.
2. Material: 0.063 inch Aluminum
3. Finish: Custom Kynar.

B. Profile types:

1. G1 Profile
2. G2 Profile
3. G4 Profile
4. G5 Profile

C. Leaf Guard Screen: Manufacturer' standard components.

D. Fabrication:

1. Concealed Gutter Liner shall be manufactured from 0.040 inch mill finished aluminum in 10 feet lengths. Liner shall be:

   a. Factory notched to receive brackets and straps.
   b. Manufactured with 1 inch telescoping and notched end laps.
   c. Factory punched with fastening holes elongated to allow for thermal movement.

2. Support Bracket and retainer stem shall be manufactured from 0.125 inch by 1.0 inch extruded aluminum bar, heliarc welded construction, factory punched for fasteners.

3. Interior Straps shall be manufactured from 0.125 inch by 1.0 inch extruded aluminum.

4. Snap-on fascia shall be manufactured from aluminum, 10 feet lengths. Fascia shall be press formed with radius dies on a CNC Press to provide repeated true and accurate profiles.

5. Fascia splices shall be manufactured from 0.040 inch aluminum, 6 inches lengths, formed to fit the inside of the snap-on fascia.

6. Corners shall be factory mitered corners for both fascia and liner. Fascia profiles shall be precision saw cut, heliarc tack welded to produce a picture frame joint. Concealed liner miter shall be precision saw cut with a continuous heliarc weld watertight joint.

7. Sculptured end caps shall be factory mitered end caps for fascias. Fascia profiles shall be precision saw cut, heliarc tack welded to produce a picture frame joint.

8. Cornice returns, if shown on drawings, shall be provided at gutter terminations in lengths as indicated on plans.

9. Liner end caps shall be provided of mill finished aluminum at all fascia end caps and wall abutments.

10. Liner expansion Joint, provide manufacturer's elastomeric expansion joints at 40 feet intervals or as shown on shop drawings.

2.08 DRAIN WARE

A. Provide downspouts as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. as detailed on the drawings.

1. Size/ Configuration: 4” x 4” min. rectangular, 4” round min. or as indicated on the drawings.
2. Material: .125 inch (rectangle) Aluminum or .120 inch (round) Aluminum.

B. Style Types:

1. Rectangular Extruded
2. Round Extruded

C. Downspouts: Finish to match gutters unless noted otherwise.

D. Provide downspout in sizes and locations as indicated on plans. Downspouts shall be manufactured from aluminum, finished to match gutter fascia. Downspout elbows shall have heliarc welded joints.

E. Hardware: Finish to match gutters unless noted otherwise.

1. Outlets: At downspout locations provide aluminum outlets to connect liner to downspout.
2. Wall Brackets: Provide brackets at 60 inches maximum spacing (minimum 2 brackets). Brackets shall be manufactured from 0.125 inch by 1.0 inch extruded aluminum bar, finished to match downspout

2.09 FINISHES

A. All aluminum gutters and downspouts shall be chrome phosphate pre-treated at the factory.

B. The finish of all gutters, downspouts, and accessories shall be high-performance (Kynar-base) “*Duranar*” AAM 10-C41-RIX (with 70 percent PVDF, minimum) by PPG or Architect approved equal. Any paint finish other than Kynar must be listed as a substitute. Minimum thickness of finish to be 1.2 mils and shall conform to AAMA 605.2-93 Duranar. Color to be as selected by the Architect.

2.10 FABRICATION

A. General: Shop fabricate work to the greatest extent possible. Comply with details shown and with applicable requirements of SMACNA “Architectural Sheet Metal Manual” and other recognized industry practices. Fabricate for waterproof and weather resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Shop/field fabricate aluminum sheet metal fascia, gutters, downspouts, collection boxes, scuppers, and flashings to configurations indicated on the drawings.

1. Fabricate from .063 inch aluminum sheet metal, unless otherwise noted or required to meet SMACNA recommended minimum gauge, with factory applied finish as specified in Article 2.09 – *Finishes*.

a. Use .063-inch aluminum sheet when face is wider than 6 inches to prevent “oil-canning” or sagging.

b. Provide gutter profile indicated and closed face downspouts.

c. Provide elbows, outlet tubes, stainless steel strainers, adapters, and other accessories as required for complete installation.

d. Expansion Joints: Provide where indicated but not more than 50 feet on center maximum. Comply with SMACNA Fig. 1-6 or 1-7.

PART 3 EXECUTION

3.01 EXAMINATION

A. General: The Installer must examine substrates and conditions under which cornices, mouldings, gutters and downspouts will be installed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 PREPARATION

A. Separate dissimilar metals from each other by painting each metal surface in area of contact with a heavy application of bituminous coating.

B. Clean surfaces thoroughly prior to installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for project conditions.

D. The installer shall examine substrates and conditions under which cornice and decorative profiles will be installed. All wood plates and/or fascia boards shall be installed true, straight, and free of splits, cracks, or other irregularities. Do not proceed with installation until unsatisfactory conditions are corrected.

E. The installer shall field verify that framing has been built in accordance with the dimensions furnished by the cornice manufacturer either by shop drawings or published literature. Do not proceed with installation until unsatisfactory conditions are corrected.

3.03 INSTALLATION

A. Except as otherwise indicated, comply with manufacturer’s installation instructions and recommendations and with SMACNA “Architectural Sheet Metal Manual”.

B. Install work with provisions for thermal expansion of gutters, flashings, gravel stops, coping, fascia, and other items exposed for more than 15 feet continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams where shown, or if not shown, in conformance with applicable recommendations of “Architectural Sheet Metal Manual” by SMACNA.

C. Sheet metal work shall be watertight and weather-tight; lines, arrises, and angles sharp and true; plain surfaces free from waves and buckles. Workmen shall be experienced in the trade and thoroughly capable of performing the work in accordance with these requirements.

D. Cornice:

1. Follow manufacturer's guidelines and shop drawings for installing pre-designed cornice and decorative trims. If cornice or trims join a roof system then follow primary roofing manufacturer's printed instructions for installing associated roof material for flashing decorative trims to roof.

2. The pre-designed cornice and decorative trims shall be installed in strict accordance with manufacturer's printed instructions and shop drawings.

3. Fastening: Cornice trims shall be nailed through elongated holes with 1-1/2 inches stainless steel nails. Support brackets, retaining brackets and attachment brackets shall be installed with #10 by 2 inches stainless steel wood screws at locations and spacing as shown on shop drawings.

4. Install cornice profiles and decorative trims with concealed splice plates over brackets and/or framing substrates as shown on shop drawings. In accordance with shop drawings:

   a. Coordinate and align spacing of expansion reveal joints with associated trims (stack joints).
   b. Plan spacing of joints so there is no sections of fascia shorter than 48 inches in length.
   c. Check horizontal alignment of fascia during installation and adjust as required

5. Cover joints with strips of same material, screwed and caulked in place with appropriate sealant of matching color.

E. Gutters and Downspouts:

1. Review carefully and follow primary roof materials manufacturer’s general recommendations as to installing waterproof membranes to this gutter system.

2. Support Brackets: Layout support brackets to provide 1/2 inch slope in 40 linear feet. Install support brackets with #10 by 2 inches stainless steel wood screws.

3. Liner: Install concealed gutter liner onto support brackets and fasten to substrates with 1-1/2 inches (38 mm) aluminum or stainless steel nails. Rivet and seal liner joints with high grade exterior sealant as recommended by gutter manufacturer.

4. Inside Strap Installation: Install inside straps at 30” on center alternating with support brackets. Strap shall be hooked into slotted holes at leading edge (bead) of gutter and riveted at its rear side. In no case shall strap be nailed, screwed, or otherwise fastened which would restrain thermal movement of product.

5. Install fascia with concealed splice plates over support brackets and liner. Coordinate and align spacing of joints with associated trims if applicable. Plan spacing of joints so there are no sections of fascia shorter than 48 inches (1219 mm) in length. Check horizontal alignment of fascia during installation and adjust as required. At downspout locations, neatly cut fascia to accommodate downspout.

6. Expansion Joints: Install elastomeric expansion joints as shown on plans and/or shop drawings. Maximum expansion joint spacing shall be 40 feet centers.

7. Miter Corners: Install manufacturer’s welded miter units at all corners, and/or at locations shown on plans. Gutter corner shall have 30” legs, pre-punched, notched, and telescoping to match gutter.

8. End Caps/Terminations: Install manufacturer’s end caps at all end terminations.

9. Outlets: Locate all outlet locations and field cut hole in a neat workmanlike manner. Hole shall be located a distance of 1” from backside of gutter. Insert manufacturer’s outlet, fasten in place.

10. Gutters are to accommodate downspouts at a 30’ maximum interval.

11. Elbows: Unless otherwise indicated, all elbows shall be supplied at 45° angles. If requested

by the Architect, custom angles will be supplied and provided, at no additional cost to the School District.

12. Hangers/Wall Brackets: A minimum of 2 wall brackets per downspout shall be used and maximum space of 5'. General Contractor shall provide firm substrate attachment for all brackets. All brackets shall have 2 factory-provided 1/4" holes (pre-punched) for fastening, use 1-1/2" stainless steel vandal-proof expansion fasteners for masonry, #10 x 1-1/2" wood screws for wood, and 1/4" x 1" screws for metal. All downspouts shall be fastened with (4) 1/8" x 3/8" pip-rivets (Style 2 "U" brackets).

13. Outlets: Outlet tubes shall be used to connect downspouts to gutters. Outlets are to be 1/4" smaller than the downspouts for a slip-fit connection. Outlets are to be fabricated of thin stainless steel with 1/2" flanges designed to be inserted through the gutter and riveted in place with (4) 1/8" x 1/4" pip rivets. Downspouts shall be held 1" from wall, typically.

3.04 CLEANING AND PROTECTION

A. Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch-up damaged metal coatings.

B. Protection: Provide protective measures as required to ensure that work of this section will be without damage or deterioration at time of Substantial Completion.

3.05 GUARANTEE

A. Upon acceptance of the finished work by the Owner, the Contractor shall furnish a written guarantee covering materials and workmanship in accordance with the Supplemental Conditions.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 078100 – SPRAY- APPLIED FIRE RESISTIVE MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section consists of the furnishing of all labor, materials, equipment, and services necessary for, and incidental to, the complete and proper installation of all spray-applied fire resistive materials and related work as shown on the drawings or where specified herein, and in accordance with all applicable requirements of the Contract Documents.

B. The material and installation shall conform to the applicable building code requirements and the requirements of all authorities having jurisdiction.

1.02 RELATED SECTIONS

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Related Sections include the following:

1. Section 042000 – Unit Masonry
2. Section 051200 – Structural Steel
3. Section 052100 – Steel Joist Framing
4. Section 053000 – Metal Decking
5. Section 078400 - Firestopping

1.03 REFERENCES

A. American Society of Testing Materials (ASTM):

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
2. ASTM E 119 - Standard Methods of Fire Tests of Building Construction and Materials.
3. ASTM E136 – (Noncombustibility) Behavior of Materials in a Vertical Tube Furnace at 750^{o} C.
4. ASTM E 605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members.
5. ASTM E 736 - Cohesion/Adhesion of Sprayed Fire-Resistive Material Applied to Structural Members.
6. ASTM E 759 - Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
7. ASTM E 760 - Effect of Impact on Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.
8. ASTM E 761 - Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.
9. ASTM E 859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.
10. ASTM E 937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.
11. ASTM E 1354 - Cone Calorimeter.
12. ASTM G 21 - Standard Practice for Determining Resistance of Polymeric Materials to Fungi.

B. Bureau of Building Inspection: City of San Francisco.

1. Abrasion Resistance Test Method.

2. Impact Penetration Test Method.

C. Underwriters Laboratories, Inc. (UL), Fire Resistance Directory (Latest Edition).

D. Uniform Building Code (UBC):

1. UBC Standard No. 7-6: Thickness and Density Determination for Spray-Applied Fireproofing.
2. UBC Standard No. 7-7: Methods for Calculating Fire Resistance of Steel, Concrete, and Wood Construction.

E. Uniform Mechanical Code (UMC) Standard 6-1.

F. AWCI Publication: Standard Practice for the Testing and Inspection of Field-Applied Sprayed Fire-Resistive Materials; Technical Manual 12-A; an annotated guide.

1.04 DEFINITIONS

A. Cementitious Fireproofing as defined by Underwriters Laboratories, Inc., (CALV) in the latest edition of the UL Fire Resistance Directory.

1.05 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's specifications, including certification as may be required to show material compliance with Contract Documents.

B. Fire Testing: Submit evidence that the cementitious fireproofing has been subjected to full-scale ASTM E 119 fire testing at Underwriters Laboratories, Inc., by the manufacturer.

C. Thickness Schedule: Provide schedule indicating material to be used, building elements to be protected with spray-applied fireproofing, hourly rating and material thickness provided, and appropriate references.

D. Test Data: Independent laboratory test results for fireproofing shall be submitted for the following performance criteria:

1. Bond Strength per ASTM E 736.
2. Compressive Strength as per ASTM E 761.
3. Deflection per ASTM E 759.
4. Bond Impact per ASTM E 760.
5. Air Erosion per ASTM E 859.
6. Corrosion Resistance per ASTM E 937.
7. Abrasion Resistance (Test Method developed by the City of San Francisco, Bureau of Building Inspection).
8. Impact Penetration (Test Method developed by the City of San Francisco, Bureau of Building Inspection).
9. High Speed Air Erosion per UMC Standard 6-1 and ASTM E 859.
10. Surface Burning Characteristics per ASTM E 84.
11. Combustibility per ASTM E 1354 Cone Calorimeter.
12. Mold Resistance per ASTM G 21 and UMC Standard 6-1.

E. Manufacturer’s verification that fireproofing material contains at least 20% combined post-consumer and post-industrial recycled content.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Before proceeding with the fire protection work, approval of the proposed material thicknesses and densities shall be obtained from the architect and other applicable authorities.

C. Products, execution, and fireproofing thicknesses shall conform to the applicable code requirements for the required fire-resistance ratings.

D. Contractor, fireproofing subcontractor, and independent testing laboratory shall attend a pre-installation conference to review the substrates for acceptability, method of application, applied thicknesses, inspection procedures, and other issues.

E. It is recommended that industry guidelines as noted in National Fireproofing Contractors Association (NFCA) 100 – Standard Practice for the Application of Spray-Applied Fire Resistive Materials (SFRMs) and/or NFCA 300 – Standard Practice for the Application of Thin-Film Intumescent Fire-Resistive Materials be maintained on the project site.

1.07 PRECONSTRUCTION TESTING FOR SPRAY-APPLIED FIRE RESISTIVE MATERIALS

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on fireproofing.

1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.

4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers

1.08 DELIVERY, STORAGE, AND HANDLING

A. Material shall be delivered in original unopened packages, fully identified as to manufacturer, brand, or other identifying data and bearing the proper Underwriters Laboratories, Inc., labels for Surface Burning Characteristic and Fire Resistance Classification.

B. Material shall be stored above ground, off the ground, under cover, and in a dry location, protected from weather, moisture and areas of high humidity, until ready for use. All bags that have been exposed to water before use shall be found unsuitable and discarded. Damaged packages found unsuitable for use should be rejected and removed from the project. Stock of material is to be

rotated and used prior to its expiration date.

C. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of other trades.

D. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

1.09 PROJECT/SITE CONDITIONS

A. Environmental Limitations – Spray-Applied Fire Resistive Materials: Do not apply fireproofing when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level prior to, during, and for 24 hours after product application. If necessary for job progress, General Contractor shall provide enclosures with heat to maintain temperatures.

B. Environmental Limitations – Intumescent Fire Resistive Materials: Do not apply when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level prior to, during, and for 72 hours after product application. Relative humidity shall not exceed 85% throughout the total period of application and drying for the IFRM, and must not exceed 85% throughout the application and drying for the protective decorative topcoat.

C. Ventilation: Ventilate building spaces during and after application of fireproofing, providing a minimum 4 complete air exchanges per hour and according to manufacturer's written instructions until Spray-Applied Fire Resistive Materials and / or Intumescent Fire Resistive Materials are dried and cured. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

1.10 SEQUENCING AND SCHEDULING

A. Sequence and coordinate application of cementitious fireproofing with work in other sections which would interfere with efficient fireproofing application.

B. All fire protection work on a floor shall be completed before proceeding to the next floor.

C. The Contractor shall cooperate in the coordination and scheduling of fire protection work to avoid delays in job progress.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119/UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.

E. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Asbestos: Provide products containing no detectable asbestos.

G. Products shall posses DECLARE Label.

1. Declaration Status "LBC Red List Free".

H. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

2.02 MATERIALS (LOW DENSITY)

A. Design is based on CAFCO® 300 Series / ISOLATEK® Type 300 Series, CAFCO® BLAZE-SHIELD® II / ISOLATEK® Type II Series spray-applied fireproofing as manufactured by Isolatek International. Equal products of other manufacturers, approved in advance by the Architect, may be substituted.

B. Physical Performance Characteristics: Fireproofing material shall be applied to conform to the drawings and specifications and the following test criteria:

1. Dry Density: The field density shall be measured in accordance with ASTM Standard E 605. Minimum average density shall be that listed in the UL Fire Resistance Directory for each rating indicated, ICBO Evaluation Report, as required by the authority having jurisdiction, or minimum average 240 kg/cubic meter (15 pcf), whichever is greater.

2. Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical centerload resulting in a downward deflection of 1/120th of the span.

3. Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.

4. Cohesion/Adhesion (Bond Strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 150 psf (7.2 kPa).

5. Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft. (0.27 grams per square meter). Sample surface shall be "as applied" (not pre-purged) and the total reported weight loss shall be the total weight loss over a 24 hour period from the beginning of the test.

6. High Speed Air Erosion: Materials to be used in plenums or ducts shall exhibit no continued erosion after 4 hours at an air speed of 12.7 m/s (47 km/h) (2,500 ft/min [29 mph]) when tested in accordance with the UMC Standard 6-1 and ASTM E 859.

7. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 750 psf (35.9 kPa).

8. Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.

9. Noncombustibility: When tested in accordance with ASTM E136, the material shall be noncombustible.

10. Abrasion Resistance: No more than 15 cm^3 shall be abraded or removed from the fireproofing substrate when tested in accordance with the test methods developed by the City of San Francisco, Bureau of Building Inspection.

11. Impact Penetration: The fireproofing material shall not show a loss of more than 6 cm^3 when subjected to impact penetration tests in accordance with the test methods developed by the City of San Francisco, Bureau of Building Inspection.

12. Surface Burning Characteristics: When tested in accordance with ASTM E84, the material shall exhibit the following surface burning characteristics:

    a. Flame Spread: 0.
    b. Smoke Developed: 0.

13. Resistance to Mold: The fireproofing material shall be formulated at the time of manufacturing with a mold inhibitor. Fireproofing material shall be tested in accordance with ASTM G 21 and shall show resistance to mold growth for a period of 21 days for general use and 60 days for materials to be installed in plenums.

14. Combustibility: Material shall have a maximum total heat release of 20 MJ/m^2 and a maximum of 125 kw/m^2 peak rate of heat release 600 seconds after insertion when tested in accordance with ASTM E 1354 at a radiant heat flux of 75 kw/m^2 with the use of electric spark ignition. The sample shall be tested in the horizontal orientation.

15. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/ULC design or as required by the authority having jurisdiction, or shall have a minimum average of 15 pcf (240 kg/m3).

C. Fire Resistance Classification: The spray-applied fireproofing material shall have been tested and reported by Underwriters Laboratories, Inc., in accordance with the procedures of UL 263 (ASTM E119) and shall be listed in the Underwriters Laboratories Fire Resistance Directory.

D. Spray-applied fire resistive materials shall be applied at the total thickness shown and at the locations as indicated on the contract drawings.

E. Mixing water shall be clean, fresh, and suitable for domestic consumption and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material. Provide water with sufficient pressure and volume to meet the fireproofing application schedule.

F. Spray-applied fire resistive materials shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall provide certification of such upon request.

2.03 MATERIALS (MEDIUM DENSITY)

A. Design is based on CAFCO® 400 Series / ISOLATEK® Type 400 Series, CAFCO® BLAZE-SHIELD® HP / ISOLATEK® Type HP spray-applied fireproofing as manufactured by Isolatek International. Equal products of other manufacturers, approved in advance by the Architect, may be substituted.

B. Physical Performance Characteristics: Fireproofing material shall be applied to conform to the drawings and specifications and the following test criteria:

1. Dry Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/UC design or as required by the authority having jurisdiction, or shall have a minimum average of 22 pcf (352 kg/m3)

2. Cohesion/Adhesion (Bond Strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 434 psf (20.8 kPa).

3. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf (351 kPa).

All other test criteria and physical performance characteristics shall be in accordance with the values listed above in 2.02.

2.04 MATERIALS (HIGH DENSITY)

A. Design is based on CAFCO® FENDOLITE® M-II / ISOLATEK® Type M-II, CAFCO® FENDOLITE® TG / ISOLATEK® Type TG spray-applied fireproofing as manufactured by Isolatek International. Equal products of other manufacturers, approved in advance by the Architect, may be substituted.

B. Physical Performance Characteristics: Fireproofing material shall be applied to conform to the drawings and specifications and the following test criteria:

1. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.

2. Dry Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL design or as required by the authority having jurisdiction, or shall have a minimum average of 44 pcf (704.8 kg/m3)

3. Cohesion/Adhesion (Bond Strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 1,000 psf (47.9 kPa).

4. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 43,200 psf (2068 kPa).

All other test criteria and physical performance characteristics shall be in accordance with the values listed above in 2.02.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Fireproofing manufacturer shall be contacted for procedures on handling primed/painted steel.

2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series

of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass or carbon fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

G. Sealer: If required, a transparent-drying, water-dispersible, tinted protective coating as recommended by fireproofing manufacturer.

1. Product: Subject to compliance with requirements, provide CAFCO® BOND-SEAL / ISOLATEK® Type EBS or CAFCO® BOND-SEAL Type X / ISOLATEK® Type X by Isolatek International.

H. Topcoat: If required, a topcoat suitable for application over applied fireproofing; of type recommended by fireproofing manufacturer.

1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.

2. Product: Subject to compliance with requirements, provide CAFCO® FENDOLITE® M-II/TG / ISOLATEK® Type M-II/TG by Isolatek International.

3. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM. Provide application at a rate of 30 sq. ft./gal.

4. Product: Subject to compliance with requirements, provide CAFCO® TOP-COTE by Isolatek International.

2.06 INTUMESCENT FIRE RESISTIVE MATERIALS

A. IFRM: Manufacturer's standard, factory-mixed formulation consisting of intumescent base coat and complying with indicated fire-resistance design.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Interior - Isolatek International; CAFCO® SprayFilm® WB 5™ / ISOLATEK® Type WB 5 and CAFCO® SprayFilm® WB 3™ / ISOLATEK® Type WB 3.

b. Exterior - Isolatek International; CAFCO® SprayFilm® WB 4™ / ISOLATEK® Type WB 4 with CAFCO SprayFilm Topseal™ / ISOLATEK® Type Topseal.

2. Compliance: In accordance with ASTM E2924 for the testing, labeling, transportation, delivery, storage, shelf life, application and inspection of intumescent coatings.

3. Application: Designated for exterior, interior general purpose, and conditioned interior space purpose use by a qualified testing agency acceptable to authorities having jurisdiction.

4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.

5. Physical Properties:

   a. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

      1) Flame-Spread Index: 5 – 15.
      2) Smoke-Developed Index: 0 – 35.

   b. Durometer Hardness: ASTM D2240 – Minimum: 67 Shore D.

   c. Impact Resistance: ASTM D2794 – Intrusion minimum: 98 inch-lb.(11.0 Nm).

   d. Abrasion Resistance: ASTM D4060 – Maximum 0.2600 grams/1000 cycles.

   e. Bond Strength: ASTM D4541 – Minimum: 280 psi. (1931 k Pa.)

6. Finish: As selected by Architect from manufacturer's standard finishes; Spray-textured finish.

   a. Color and Gloss: As indicated by manufacturer's designations.

B. Auxiliary Materials:

1. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

2. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

3. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

   a. Interior – Topcoat materials shall be as required for color-coding aesthetics or additional surface protection, and approved by the IFRM manufacturer.

   b. Exterior – CAFCO SprayFilm Topseal / ISOLATEK Type Topseal must be applied over CAFCO SprayFilm WB 4 / ISOLATEK Type WB 4 per specified design listings. Exterior finish coat materials are required over SprayFilm Topseal for color-coding aesthetics or additional surface protection, and approved by the IFRM manufacturer.

2.07 RIGID BOARD FIRE RESISTIVE MATERIALS

A. Rigid Board Fire Resistive Materials: Rigid boards of produced from asbestos free materials by combining refractory mineral wool manufactured from slag with thermosetting resin binders.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CAFCO-BOARD® / ISOLATEK Type CB Rigid Board Fire Resistive Material (UL Designation: Type CB) by Isolatek International.

2. Properties:

   a. Surface Burning Characteristics: Maximum Flame Spread and Smoke Developed ratings of 15 and 5, respectively.

   b. Thermal Conductivity (R Value/inch): ASTM C-612 for Class 4 4.2 at 75° F (24° C).

   c. Nominal density: 9 pcf (144 kg/m^3)

B. Auxiliary Materials:

   1. Fastening Accessories: For each fire resistive assembly in which rigid board fire resistive materials serves as rigid fire protection, provide a board fastening system complying with the related UL design or other acceptable testing and inspecting organization's report.

2.08 SOURCE QUALITY CONTROL

A. Submit evidence that spray-on fireproofing has been tested per ASTM E 119 by Underwriters Laboratories, Inc. Include evidence that fire testing was sponsored by the manufacturer and that the material tested was produced at the manufacturer's facility under the supervision of Underwriters Laboratories, Inc., personnel. *Letters documenting classification status are not acceptable evidence of compliance with this section.*

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

   1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

   2. Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others prior to the application of the fireproofing materials.

   3. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of the fireproofing is complete in an area.

B. Manufacturer shall be contacted for procedures on handling primed/painted steel. Where necessary, cleaning or other corrections of surfaces to receive fireproofing shall be the responsibility of the supplier of the incompatible substrate.

   1. ***Contractor's Note: The use of paints or primers on structural steel to receive spray-applied fire resistive material will not be allowed. Constraints have been placed upon this type of application by U.L. and are detailed in the Coating Materials Section in the front of the U.L. Fire Resistance Directory Volume 1.***

C. Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

D. The application of Spray-Applied Fire Resistive Materials to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

E. The spray-applied fire resistive material shall only be applied to steel deck which has been fabricated and erected in accordance with the criteria set forth by the Steel Deck Institute.

   To ensure proper fire protection adhesion:

   1. All structural steel scheduled to receive fire protection shall be left unprimed;

   2. All steel decking scheduled to receive fire protection shall be galvanized and not primed or painted.

F. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

G. Application of the fireproofing shall not begin until the contractor, applicator, and fireproofing testing laboratory (inspector) have examined surfaces to receive fireproofing and determined that the surfaces are acceptable to receive the fireproofing material. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prior to application of the fireproofing material, a bonding agent, approved by the fireproofing material manufacturer, shall be applied to all concrete substrates to receive fireproofing.

B. Complete placing of concrete on floor and roof decking prior to application of the fireproofing to the underside of the steel deck and supporting beams and joists.

C. On roof decks without a concrete cover, complete all roofing applications and roof mounted equipment installation prior to application of the fireproofing to the underside of the roof decking and supporting beams and joists. Prohibit all roof traffic upon commencement of the fireproofing and until the fireproofing material is dry.

D. Protection of permanently exposed walls or floor or special surfaces.

E. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

F. Clean substrates of substances that could impair bond of fireproofing.

G. Prepare substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

H. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.03 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.

2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.

2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

3. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes – Spray-Applied Fire Resistive Materials: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

2. Spray-Textured Finish: Finish left as spray-applied with no further treatment.

3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

O. Equipment, mixing and application shall be in accordance with the manufacturer's written application instructions.

P. Post appropriate cautionary "Slippery When Wet" signs in all areas in contact with wet fireproofing material. Erect appropriate barriers to prevent entry by non-fireproofing workers into the fireproofing spray and mixing areas and other areas exposed to wet fireproofing material.

Q. The application of spray-applied fire resistive material shall not commence until certification has been received by the General Contractor that surfaces to receive sprayed fire protection have been inspected by the applicator and are acceptable to receive sprayed fire protection.

R. Proper temperature and ventilation shall be maintained as specified in 1.08 A, 1.08B and 1.08C.

S. Bonding materials (adhesives, catch coats, metal lath, mesh, stud pins, etc.) shall be applied as per the appropriate UL/ULC fire resistance design and manufacturer's written recommendations.

T. Topcoat material, if any, shall be the type recommended and approved by the manufacturer of each spray-applied fire resistive material required for the applications indicated.

3.04 PATCHING OF FIRE-PROTECTION AREAS REMOVED OR DAMAGED

A. The General Contractor shall repair any fire protection removed or damaged by work done by other trades. This may include, but not be limited to such items as: suspended ceilings, fire protection systems, mechanical, electrical, curtain wall systems, precast concrete, EIFS systems, etc. The General Contractor shall utilize the same materials for patch as new installation. Patch and repair of spray-on fireproofing, due to damage by other trades, shall be performed by the General Contractor, and paid for by the trade(s) responsible for the damage. This shall also include work damaged by the General Contractor’s own subcontractors; General Contractor shall remain responsible for said repairs.

3.05 FOR ASBESTOS ABATEMENT PROJECTS WITH FIRE PROTECTION RE-SPRAY

A. The asbestos lockdown or encapsulant must be tested in conjunction with the spray-applied fire resistive material in accordance with ASTM E119.

B. The lockdown as applied by the abatement contractor must be compatible with the specific fire protection material. (The lockdown material shall not be approved until the specific fire protection is approved).

3.06 REPAIRING AND CLEANING

A. All patching of and repair to sprayed fire protection, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage.

B. After the completion of the work in this section, equipment shall be removed and all surfaces not to be sprayed shall be cleaned to the extent previously agreed to by applicator and General Contractor.

3.07 INSPECTION AND TESTING

A. The spray-applied fire resistive material shall be tested for thickness and density in accordance with one of the following procedures:

ASTM E605 - *Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members*.

AWCI - *Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials*, Technical Manual 12-A; an annotated guide.

UBC Standard No. 7-6 - *Thickness and Density Determination for Spray-Applied Fire Protection*.

3.08 FIELD QUALITY CONTROL

A. The Architect will select, and the Owner will pay an independent testing laboratory to randomly sample and verify the thickness and the density of the fireproofing in accordance with provisions of ASTM E 605, or the "*Inspection Procedure for Field-applied Sprayed Fire Protection Materials*" as published by the Association of Wall and Ceiling Contractors International (AWCI), or the Uniform Building Code Standard No. 7-6. Where density samples are of irregular shape, a displacement method approved by Underwriters Laboratories, Inc., shall be used to determine in place fireproofing density.

B. The Architect will select, and the Owner will pay an independent testing laboratory to randomly sample and verify the bond strength of the fireproofing in accordance with provisions of ASTM E 736.

C. The results of the above tests shall be made available to all parties at the completion of pre-designated areas, which shall have been determined during the pre-job conference.

D. Application will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.

2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

3.09 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

F. After the completion of fireproofing work, application equipment shall be removed.

G. Except as detailed above, floors shall be left in a scraped condition.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 078413 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

B. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

C. Blank openings through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

D. Openings and penetrations in fire-rated partitions or walls containing fire doors.

E. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 033000 - Cast-In-Place Concrete
2. Section 042000 - Unit Masonry
3. Section 078443 - Joint Firestopping
4. Section 079200 - Joint Sealants
5. Section 092900 - Gypsum Wall Board
6. Section 210000 - Fire Suppression
7. Section 220000 - Plumbing
8. Section 230000 - Heating, Ventilating, and Air Conditioning
9. Section 260000 - Electrical

1.05 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, “Fire Tests of Through-Penetration Firestops”

C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:
   a. Firestop Devices (XHJI)
   b. Fire Resistance Ratings (BXRH)
   c. Through-Penetration Firestop Systems (XHEZ)
   d. Fill, Voids, or Cavity Material (XHHW)
   e. Forming Materials (XHKU)

D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

E. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.

F. Inspection Requirements: ASTM E 2174, “Standard Practice for On-site Inspection of Installed Fire Stops.”

G. Building Code of New York State.

H. NFPA 101 - Life Safety Code

I. NFPA 70 - National Electric Code

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems that comply with specified requirements of tested systems.

B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified firestop systems to be used and manufacturer's installation instructions to comply with Section 013300.

B. Manufacturer's engineering judgment identification number and drawing details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in document.

C. Submit safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. The work is to be installed by a contractor with at least one of the following qualifications:

1. FM 4991 Approved Contractor
2. UL Approved Contractor
3. Hilti Accredited Fire Stop Specialty Contractor

C. Firm with not less than 3 years experience with fire stop installation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING - GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service

and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.

2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.

E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

F. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of zero (0) as determined by ASTM G21.

G. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturer as identified below:

B. Basis of Design: Hilti, Inc., Plano, Texas, 800-879-8000, www.us.hilti.com.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Pre-formed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors the following products are acceptable:

1. Hilti Cast-In Place Firestop Device (CP 680-P)
   a. Add Aerator Adaptor when used in conjunction with aerator system.
2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
3. Hilti Cast-in Place Firestop System for Metal Decks (CFS CID MD P) including all components as described by manufacturer for proper installation.

4. Hilti Cast-in Place Firestop System for Metal Decks (CFS CID MD M) including all components as described by manufacturer for proper installation, for use with noncombustible penetrants.
5. Hilti Tub Box Kit (CP 681) for use with tub installations.
6. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
7. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
8. Hilti Firestop Block (CFS-BL)
9. Hilti Closet Stub (CFS-CID CS)

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
2. Hilti Fire Foam (CP 620)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti Silicone Sealant Gun Grade (CFS-S SIL GG)
2. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Intumescent Firestop Sealant (FS-ONE MAX)

E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)

F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
2. Hilti Fire Foam (CP 620)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

G. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Firestop Putty Stick (CP 618)
2. Hilti Firestop Plug (CFS-PL)

H. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti Firestop Putty Pad (CFS-P PA)
2. Hilti Firestop Putty Pad (CP 617)
3. Hilti Firestop Box Insert

I. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti Firestop Collar (CP 643N)
2. Hilti Firestop Collar (CP 644)
3. Hilti Wrap Strips (CP 648-E/648-S)

J. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Composite Sheet (CFS-COS)
3. Hilti Firestop Mortar (CP 637)
4. Hilti Fire Foam (CP 620)
5. Hilti Firestop Board (CP 675T)

K. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Board (CP 675T)

L. Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:

1. Hilti Firestop Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
2. Hilti Firestop Cable Collar (CFS-CC)
3. Hilti Firestop Sleeve (CFS-SL SK)
4. Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
5. Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
6. Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.

M. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits or cables is expected, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Plug (CFS-PL)

N. For single or cable bundles up to one inch diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies the following product is acceptable:

1. Hilti Firestop Cable Disc (CFS-D)

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector, per requirements of Section 109, International Building Code 2000, ed.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

E. Manufacturer’s Field Services: Contractor to ensure a manufacturer’s direct representative is on-site during initial installation of firestop systems to train appropriate contractor personnel in proper

selection and installation procedures. Training will be done per manufacturer's written recommendations published in their literature and drawing details. During installation, contractor shall have manufacturer's representative provide periodic visual observations and written documentation of the results. Contact Hilti for support at 800.879.8000.

3.05 IDENTIFICATION & DOCUMENTATION

A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.

1. A.1 The Documentation Form for through penetrations is to include:
2. A Sequential Location Number
3. The Project Name
4. Date of Installation
5. Detailed Description of the Penetration's Location
6. Tested System or Engineered Judgment Number
7. Type of Assembly Penetrated
8. A Detailed Description of the Size and Type of Penetrating Item
9. Size of Opening
10. Number of Sides of Assemblies Addressed
11. Hourly Rating to be Achieved
12. Installer's Name

B. Copies of these documents are to be provided to the general contractor at the completion of the project.

C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning: Through Penetration Firestop System – Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

D. A firestop documentation manager software shall be used to document, track, and maintain the passive firestop systems throughout the construction and maintenance phase of the facility. The software solution shall be used to track and document every firestop system installed on the project and each subsequent addition, change, or removal of the firestop system. The firestop documentation shall be managed with a cloud-based software which allows the installer to use a standard smartphone or tablet device (either iOS, Android or Windows capable) to capture the relevant information for the installation. The following data shall be tracked for each penetration within the facility: product installed, system installed, date of installation, location of the penetration including a notation on the 2D plan image, F-rating, name of installer, photo (pre-installation and post-installation), and inspection status. The Owner and/ or Construction Manager may designate additional items to be tracked. The firestop documentation manager software must perform the following basic functions:

E. Create multiple projects/ facilities, add/create/ remove users for each project, upload documents including UL systems, 2D floor plans, product data, engineering judgments, etc.

F. Define data to track using pre-defined input fields or creating custom input fields as desired.

G. Capture multiple photos for each penetration, including a pre-installation and post-installation photo.

H. Scan QR Code on Hilti identification label to link the program data to a specific penetration location.

I. Annotate (mark) location of penetration on 2D floor plan.

J. Create reports by filtering data and utilizing report templates.

K. Online/ offline (for use in areas where data service is unavailable) synchronization of data between mobile device, online application and cloud-based system.

L. Ability to transfer ownership of projects from one customer to another from construction phase to facility maintenance.

Permanently attach Hilti identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to quickly identify the penetration attributes.

Acceptable Software: Hilti CFS-DM, from Hilti Inc., Tulsa, OK. Tel (800) 879-8000 or Hilti (Canada) Corporation, Mississauga, Ontario (800) 363-4458 website: www.us.hilti.com or www.hilti.ca.com

M. Single Source: Obtain firestop documentation manager software and firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

3.06 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

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3.07 SCHEDULE OF THROUGH PENETRATION FIRESTOP SYSTEMS

CONCRETE FLOORS			CONCRETE OR BLOCK WALLS		
TYPE OF PENETRANT	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**	**TYPE OF PENETRANT**	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**
CIRCULAR BLANK OPENINGS	1	F-A-0006, C-AJ-0055, C-AJ-0090	CIRCULAR BLANK OPENINGS	1	C-AJ-0055, C-AJ-0090
	2	F-A-0006, C-AJ-0055, C-AJ-0090		2	C-AJ-0055, C-AJ-0090
	3	F-A-0006, C-AJ-0055, C-AJ-0086,		3	C-AJ-0055, C-AJ-0086
SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, F-A-1028, F-A-1017	SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, W-J-1067, W-J-1020
	2	C-AJ-1226, F-A-1028, F-A-1017		2	C-AJ-1226, W-J-1067, W-J-1020, W-J-1248
	3	C-AJ-1226, F-A-1017		3	C-AJ-1226, W-J-1041, W-J-1068
	4	C-BJ -1037, C-BJ-1034		4	C-BJ-1034, C-BJ-1037, W-J-1041, W-J-1042, W-J-1068
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	F-A-2053, F-A-2025, C-AJ-2109, C-AJ-2098, C-AJ-2271, C-AJ-2167,	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342
	2	C-AJ-2098, C-AJ-2271, C-AJ-2167, C-BJ-2021, C-AJ-2371, C-AJ-2342		2	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342
	3	F-A-2054, C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342		3	C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342
	4	C-BJ 2016, C-AJ-2017		4	W-J-2057, W-J-2091
SINGLE/CABLE BUNDLES	1	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ-3283	SINGLE/CABLE BUNDLES	1	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
	2	F-A-3007,C-AJ-3095,C-AJ-3334, F-A-3060		2	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167, W-J-3189
	3	F-A-3007, C-AJ 3095, C-AJ-3285		3	C-AJ-3095, C-AJ-3180, W-J-3167
				4	W-J-3050
CABLE TRAY	1	C-AJ-4034, C-AJ-4035	CABLE TRAY	1	W-J-4027, C-AJ-4034, C-AJ-4035
	2	C-AJ-4034, C-AJ-4035		2	W-J-4027, C-AJ-4034, C-AJ-4035
	3	C-AJ-4034, C-AJ-4035		3	C-AJ-4034, C-AJ-4035
				4	W-J-8007
SINGLE INSULATED PIPES	1	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5090, C-AJ-5048	SINGLE INSULATED PIPES	1	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042
	2	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5090		2	C-AJ-5090, C-AJ-5091, C-AJ-5061, W-J-5042
	3	F-A 5016, C-AJ-5090, F-A-5018		3	C-AJ-5090, C-AJ-5061
	4	C-BJ-5006		4	C-BJ-5006, W-J-5028
ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, F-A-6002, C-AJ-6036	ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, C-AJ-6036
	2	C-AJ-6006, C-AJ-6017, F-A 6042, C-AJ-6036		2	C-AJ-6006, C-AJ-6017, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017		3	C-AJ-6006, C-AJ-6017
MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, C-AJ-7084	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	2	C-AJ-7046, C-AJ-7051, C-AJ-7085		2	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	3	C-AJ-7046, C-AJ-7051		3	C-AJ-7046, C-AJ-7051
MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	N/A**	N/A**	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	1	W-J-7029, W-J-7124
				2	W-J-7091, W-J-7112, W-J-7124
MIXED PENETRANTS	1	C-AJ 8099, C-AJ-8056, C-AJ-8143	MIXED PENETRANTS	1	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	2	C-AJ-8099, C-AJ-8056, C-AJ-8143		2	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	3	C-AJ-8099, C-AJ-8056		3	C-AJ 8041, C-AJ 8056, W-J 8007, C-AJ 8099
	4	C-AJ-8095		4	C-AJ 8095, W-J 8007
WOOD FLOORS			**GYPSUM WALLS**		
TYPE OF PENETRANT	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**	**TYPE OF PENETRANT**	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**
METAL PIPES OR CONDUIT	1	F-C-1009, F-C-1059, F-C-1168	METAL PIPES OR CONDUIT	1	W-L-1054, W-L-1058, W-L-1164, W-L-1506
	2	F-C-1009, F-C-1059, F-C-1168		2	W-L-1054, W-L-1058, W-L-1164, W-L-1506
				4	W-L-1110, W-L-1111, W-L-1165
NON-METALLIC PIPE OR CONDUIT	1	F-C-2232, F-C-2030, F-C-2160, F-C-2389	NON-METALLIC PIPE OR CONDUIT	1	W-L-2078, W-L-2075, W-L-2128
	2	F-C-2029, F-C-2030, F-C-2128, F-C-2160		2	W-L-2078, W-L-2075, W-L-2128
				4	W-L-2184, W-L-2245
SINGLE OR BUNDLED CABLES	1	F-C-3012, F-C-3110, F-C-3044	SINGLE OR BUNDLED CABLES	1	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	2	F-C-3012, F-C-3110		2	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
				3	W-L-3385, W-L-3277
				4	W-L-3139, W-L-3334
INSULATED PIPES	1	F-C-5004, F-C-5037, F-C-5036	CABLE TRAY	1	W-L-4011, W-L-4019, W-L-4081
				2	W-L-4011, W-L-4019, W-L-4081
				4	W-L 8014
	2	F-C-5004, F-C-5037	INSULATED PIPES	1	W-L-5028, W-L-5029, W-L-5047
				2	W-L-5028, W-L-5029, W-L-5047
				4	W-L-5073
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	F-C-7013	NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	W-L 7017, W-L-7040, W-L-7042, W-L-7155
				2	W-L-7040, W-L-7042, W-L-7155
INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	N/A**	INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	W-L-7059, W-L-7153, W-L-7156, W-L-7151
	2	N/A**		2	W-L-7059, W-L-7153, W-L-7156, W-L-7151
MIXED PENETRANTS	1	F-C-8009, F-C-8014, F-C-8026	MIXED PENETRANTS	1	W-L-1095, W-L-8013
				2	W-L-1095, W-L-8013
				4	W-L-8014

COMPOSITE METALDECK FLOORS			
TYPE OF PENETRANT	**FLOOR COVERAGE**	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**
CIRCULAR BLANK OPENINGS	2-1/2”	2	F-A-0040
	4-1/2”	2	F-A-0040, F-A-0041
SINGLE METALLIC PIPE OR CONDUIT (STEEL, IRON, COPPER)	2-1/2”	2	F-A-1192, F-A-1193
	4-1/2”	3	F-A-1192, F-A-1193
	4-1/2”	2	F-A-1194
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	2-1/2’	2	F-A-2310, FA-2311
	4-1/2”	2	F-A-2313, F-A-2314, F-A-2315, F-A-2316
	4-1/2”	3	F-A-2310, FA-2311, F-A-2312
SINGLE/CABLE BUNDLES	2-1/2”	3	F-A-3071, F-A-3072
SINGLE INSULATED PIPES	2-1/2”	2	F-A-5069, F-A-5070, F-A-5071
	4-1/2”	3	F-A-5069, F-A-5070, F-A-5071
MIXED PENETRANTS	4-1/2”	3	F-A-8055

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 078443 – JOINT FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested and listed firestop systems shall be used in specific locations as follows:

1. Safing slot gaps between edge of floor slabs and perimeter curtain walls.
2. Openings between structurally separate sections of wall or floors.
3. Gaps between the top of walls and ceilings or roof assemblies.
4. Expansion joints in walls and floors.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 033000 - Cast-In-Place Concrete
2. Section 042000 - Unit Masonry
3. Section 078413 - Penetration Firestopping
4. Section 079200 - Joint Sealants
5. Section 092900 - Gypsum Wall Board

1.05 REFERENCES

A. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory, Volume II, updated annually:

1. Joint Systems (XHBN)
2. Perimeter Fire Containment Systems (XHDG)
3. Fire Resistance Ratings (BXRH)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

B. Omega Point Laboratories, Inc. (OPL) Listed Products Directory, Volume II, updated annually:

1. Fire Resistant Joint Systems

C. ASTM E 1966, “Standard Test Method for Fire-Resistive Joint Systems”

D. ASTM E 1399, “Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Width of Architectural Joint Systems”

E. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”

F. ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops”

G. ASTM E 2307, “Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”

H. ANSI/UL 2079, “Tests for Fire Resistance of Building Joint Systems”

I. ASTM D6904, “Standard Practice for Resistance to Wind-Driven Rain”

J. International Firestop Council Recommended (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments

K. International Building Code (IBC 2009)

L. NFPA 101 - Life Safety Code

M. ASTM C679, “Standard Test Method for Tack-Free Time of Elastomeric Sealants”

1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation shall meet requirements of ASTM E 1966 and/or ANSI/UL 2079 tested and listed assemblies that provide fire-resistance ratings not less than that of the construction in which the joint occurs.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no tested and listed system is available through a manufacturer, an engineering judgment derived from similar tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents shall follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of tested firestop systems to be used and manufacturer's installation instructions to comply with Section 013300.

B. Manufacturer's engineering judgment identification number and details when no tested and listed system is available for an application. Engineering judgment shall include both project name and contractor’s name who will install firestop system as described in document.

C. Submit safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. The work is to be installed by a contractor with at least one of the following qualifications:

1. FM 4991 Approved Contractor
2. UL Approved Contractor
3. Hilti Accredited Fire Stop Specialty Contractor

C. Installer shall have not less than 3 years experience with fire stop installation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL or OPL label, where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

F. Comply with ASTM D 6905 (modified) for resistance to wind driven rain and water.

PART 2 - PRODUCTS

2.01 JOINT FIRESTOPPING - GENERAL

A. Provide firestopping composed of components that are compatible with each other and substrates forming joints under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each fire-resistive joint system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Joints in or between Fire Rated Construction: Provide joint firestopping systems with ratings determined per UL 2079 or ASTM E 1966:

D. F-Rating: not less than the fire resistance rating of the construction they will join.

E. Firestop Top Track Seal: For metal stud partitions installed on flat concrete slab use one-piece, pre-formed, polyurethane foam based, firestop seal for use with standard head-joint top tracks and bottom-joint tracks, and slip-type head joints in fire-rated construction at top or bottom of partition to maintain continuity of the fire-resistance-rated assembly indicated. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle-over the top track or under the bottom-track.

F. Joints at Exterior Curtain Wall / Floor Intersections: Provide joint firestopping systems with ratings determined per ASTM E 2307:

G. F-Rating: not less than the fire resistance rating of the construction they will join.

H. For edge of slab conditions with a full height vision glass, or for conditions which do not contain an insulated spandrel at the floor line, only tested system HI/BPF 120-11 issued by Intertek Laboratories shall be used. If the tested system does not meet the project conditions, an engineering judgment derived from HI/BPF 120-11 shall be submitted to local authorities having jurisdiction for their review and approval prior to installation.

I. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079:

J. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

K. Joints at Intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping systems with ratings determined by ASTM E 2837.

L. Mold Resistance: Provide joint firestopping system sealant with mold and mildew resistance rating of one (1) or less as determined by ASTM G21.

M. Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

2.02 MANUFACTURERS

A. Subject to compliance with joint systems (XHBN) listed in Volume II of the UL Fire Resistance Directory or OPL Listed Products Directory; provide products of the following manufacturer as identified below:

B. Basis of Design: Hilti, Inc., Plano, Texas, 800-879-8000, www.us.hilti.com.

2.03 MATERIALS

A. Use only firestop products that have been tested in accordance with ASTM E 1966 and/or ANSI/UL 2079 for specific rated construction conditions conforming to construction assembly type, movement capability, spacing requirements, and fire-resistance-rating involved for each separate instance.

B. Sealants, sprays, or pre-formed materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti Firestop Top Track Seal (CFS-TTS)
2. Hilti Firestop Joint Spray (CFS-SP WB)
3. Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
4. Hilti Flexible Firestop Sealant (CP 606)
5. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
6. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
7. Hilti bottom of wall sealant CP 605

C. Sealants for use as part of a Perimeter Fire Barrier System between fire-resistance-rated floors and exterior wall assemblies, the following products are acceptable:

1. Hilti Firestop Joint Spray (CFS-SP WB)
2. Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
3. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
4. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

D. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal deck profile; use as a backer for spray material.

1. Hilti Speed Plugs (CP 777)
2. Hilti Speed Strips (CP 767)

E. Provide a firestop system with an Assembly Rating as determined by ASTM E 1966 and/or ANSI/UL 2079 which is equal to the fire-resistance ratings of the construction in which the joint occurs.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
2. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
3. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
4. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Listed Products Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of construction joint materials.

1. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed joints to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities and/or independent inspection agency.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

D. Manufacturer’s Field Services: Contractor to ensure a manufacturer’s direct representative is on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. Training will be done per manufacturer’s written recommendations published in their literature and drawing details. During installation, contractor shall have manufacturer’s representative provide periodic visual observations and written documentation of the results. Contact Hilti for support at 800.879.8000.

3.05 IDENTIFICATION & DOCUMENTATION

A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.

B. The Documentation Form for Construction Joints is to include:

1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed description of the Construction Joints location
5. Tested System or Engineered Judgment Number
6. Type of Construction Joint
7. The Width of the Joint
8. The Lineal Footage of the Joint
9. Number of sides addressed
10. Hourly rating to be achieved
11. Installers Name

C. Copies of these documents are to be provided to the general contractor at the completion of the project.

D. A firestop documentation manager software shall be used to document, track, and maintain the passive firestop systems throughout the construction and maintenance phase of the facility. The software solution shall be used to track and document every firestop system installed on the project and each subsequent addition, change, or removal of the firestop system. The firestop documentation shall be managed with a cloud-based software which allows the installer to use a standard smartphone or tablet device (either iOS, Android or Windows capable) to capture the relevant information for the installation. The following data shall be tracked for each penetration within the facility: product installed, system installed, date of installation, location of the penetration including a notation on the 2D plan image, F-rating, name of installer, photo (pre-installation and post-installation), and inspection status. The Owner and/ or Construction Manager may designate additional items to be tracked. The firestop documentation manager software must perform the following basic functions:

1. Create multiple projects/ facilities, add/create/ remove users for each project, upload documents including UL systems, 2D floor plans, product data, engineering judgments, etc.

2. Define data to track using pre-defined input fields or creating custom input fields as desired.

3. Capture multiple photos for each penetration, including a pre-installation and post-installation photo.

4. Scan QR Code on Hilti identification label to link the program data to a specific penetration location.

5. Annotate (mark) location of penetration on 2D floor plan.

6. Create reports by filtering data and utilizing report templates.

7. Online/ offline (for use in areas where data service is unavailable) synchronization of data between mobile device, online application and cloud-based system.

8. Ability to transfer ownership of projects from one customer to another from construction phase to facility maintenance.

   Permanently attach Hilti identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to quickly identify the penetration attributes. Acceptable Software: Hilti CFS-DM, from Hilti Inc., Plano, TX. Tel (800) 879-8000 or Hilti (Canada) Corporation, Mississauga, Ontario (800) 363-4458 website: www.us.hilti.com or www.hilti.ca.com

E. Single Source: Obtain firestop documentation manager software and firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

3.06 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

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3.08 SCHEDULE OF MOST COMMON JOINT FIRESTOP SYSTEMS

Joint Type	F-Rating (Hr)	Hilti Basis of Design UL System	
		Joint Width Less than or Equal to 2"	Joint Width Greater than 2" Less than or Equal to 6" [4]
Concrete (**Floor to Floor**)	1	FF-D-1012, FF-D-1013[1]	FF-D-1012, FF-D-1013
	2	FF-D-1012, FF-D-1013[1]	FF-D-1012, FF-D-1013
	3	FF-D-1011, FF-D-1026[1]	FF-D-1011, FF-D-1026
	4	FF-D-1047	FF-D-1125
Concrete (**Edge of Floor Slab to Wall)**	1	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	2	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	3	FW-D-1011	FW-D-1011, FW-D-1021
	4	FW-D-1047	FW-D-1092
Concrete or Block Wall to Flat Concrete Floor (**Top-of-Wall**)	1	N/A**	N/A**
	2	HW-D-0097[1]	HW-D-1009
	3	HW-D-1008[1], HW-D 0268	HW-D-1008
	4	HW-D-1042	HW-D-1103
Concrete or Block Wall to Concrete Over Fluted Metal Deck (**Top-of-Wall)**	1	HW-D-0098	N/A**
	2	HW-D-0080, HW-D-0081, HW-D-0098	HW-D-1037
	3	N/A**	N/A**
	4	HW-D-0294	N/A**
Gypsum Wall to Flat Concrete Floor (**Top-of-Wall)**	1	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	2	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	3	HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
Gypsum Shaft Wall to (**Top-of-Wall)**	2	HW-D-0342 (FLAT CONCRETE) HW-D-0541, HW-D-0542 (CONCRETE OVER METAL DECK)	N/A**
Gypsum Shaft Wall to Concrete Floor (**Bottom-of-Wall)**	1	BW-S-0023	N/A**
	2	BW-S-0023	N/A**
Gypsum Wall to Concrete Floor (**Bottom-of-Wall)**	1	BW-S-0001, BW-S-0002, BW-S-0039	N/A**
	2	BW-S-0001, BW-S-0002, BW-S-0039	N/A**
Gypsum Wall to Concrete Over Fluted Metal Deck (**Top-of-Wall)**	1	HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-0292, HW-D-0295, HW-D-538*	HWD-1011, HWD-1012, HW-1020
	2	HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-292, HW-D-0295, HW-D0538*	HW-D-1011, HW-D-1012, HW-D-1020
	3	HW-D-0292, HW-D-0295	HWD-1011, HWD-1012, HW-1020
	4	HW-D-0292, HW-D-0295	N/A**
Concrete (**Wall to Wall**)	2	WW-D-0017, WW-D-0082	WW-D-1080, WW-D-1084
	3	WW-D-1011[1], WW-D-0032	WW-D-1011
	4	WW-D-1047	WW-D-1128
Gypsum to Concrete (**Wall to Wall)**	1	WW-D-0040	N/A**
	2	WW-D-0040	N/A**

* SEE NOTE 3 ** CONTACT HILTI FOR CURRENT UL-CLASSIFIED SYSTEM OR ENGINEER JUDGMENT DRAWING: 800-879-8000

NOTES:

1. CLASSIFIED SYSTEMS FOR 2" - 6" WIDE JOINTS MAY BE USED FOR JOINTS 2" WIDE AND LESS.
2. CONFIRM THAT MOVEMENT CAPABILITIES OF THE SELECTED UL SYSTEM MEETS OR EXCEEDS THE SPECIFIED MOVEMENT RANGE OF THE PARTICULAR JOINT.
3. SYSTEMS MARKED WITH ASTERIK (*) ARE SUITABLE FOR TOP-OF-WALL JOINTS WHERE THE FLUTED METAL DECK HAS SPRAY-ON MONOKOTE MK-6/HY FIREPROOFING.
4. VERIFY ALLOWABLE JOINT WIDTH ON SPECIFIC UL SYSTEM DRAWING.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 079100 – EXTERIOR WALL JOINT SEALS (EMSEAL)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Preformed, precompressed, expanding foam joint seals for expansion joints in exterior walls.

B. Related Sections:

1. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

2. Section 079200 – Joint Sealants

1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:

1. Convene at Project site 1 week prior to beginning work of this Section.

2. Attendance: Architect, Contractor, Construction Manager, joint seal installer and related trades.

3. Review and discuss:

a. Joint seal manufacturer's requirements, project conditions, allowable structural movement at joints, and protection of completed work.

b. Transitions in plane and direction, and requirement for continuity of seal through watertight transitions from wall expansion joint to other interfacing expansion joint systems at adjacent construction.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Indicate joint locations, dimensions, and adjacent construction.

b. Provide details for transitions in plane and direction for continuity of seal through watertight transitions from wall expansion joint to other interfacing expansion joint systems at adjacent construction.

2. Product Data: Material description and application instructions.

3. Samples:
a. Minimum 2" x 2" inch joint seal samples showing available colors.

b. Minimum 6" long samples of each joint seal.

B. Informational Submittals:

1. Manufacturer's certification that:

a. Products are capable of withstanding temperature of 150 degrees F for 3 hours while compressed to minimum of movement capability dimension without evidence of bleeding of impregnation medium from material.

b. Same material after heat stability test and after cooling to room temperature will self-expand to maximum of movement capability dimension within 24 hours at 68 degrees F.

C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. A minimum of 10 years documented experience in production of specified materials.

2. Certified to ISO 9001 and 14001.

B. Installer Qualifications: A minimum of 5 years documented experience installing similar products.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design Manufacturer: Products by Sika Emseal, 800-526-8365, www.emseal.com.

2.02 MATERIALS

A. Exterior Wall Joint Seal.

1. Source: Emshield WFR2 by Sika Emseal.

2. Description: Silicone coated, ultraviolet resistant, dual-faced, fire-rated, watertight primary wall seal.

3. Form: Precompressed to less than design joint size, packaged in shrink-wrap packaging.

4. Fire protection rating: 2 hours, tested to UL 2079.
5. Movement capability: Plus and minus 50% (total 100%) of nominal material size.

6. R-value: 1.03 per inch depth at nominal joint size compression, tested to ASTM C518.

7. STC rating: 62 in STC 68 wall, tested to ASTM E90.

8. OITC rating: 52 in OITC 52 wall, tested to ASTM E90.

9. Air permeability: Maximum 0.02 liter per second per square meter, tested to ASTM E283 at 75 Pa.

10. Water penetration: No water penetration, tested to ASTM E331 at 5000 Pa test pressure.

11. Wind loading: No deflection, tested to ASTM E330 at 4954 Pa or 200 MPH wind.

12. VOC Emissions: CDPH-1.2-2017: Pass

13. Color: To be selected from Sika Emseal full color range by Architect.

14. Adhesive: Epoxy type, furnished by joint seal manufacturer.

15. Silicone: Field applied corner bead at face of seal to substrate interface, furnished by joint seal manufacturer, in same material and color as used in factory coating.

    a. Abrasion Resistance: Less than 1% weight loss, tested to ASTM D4060
    b. Fuel Resistance: Pass, tested to ASTM C719/C1135

16. Intumescent Sealant: Field applied to face of joints, furnished by joint seal manufacturer

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean joints thoroughly; remove loose and foreign matter that could impair adhesion or performance.

3.02 INSTALLATION

A. Install joint seal in accordance with Sika Emseal instructions and approved Shop Drawings.

B. Remove joint seal from precompressed packaging, immediately insert into joint, and allow to expand.

C. Use temporary retainers if required to maintain joint seals in position until expansion is complete.

3.03 JOINTS SEAL SCHEDULE

A. Exterior Wall Joint Seals at locations shown on the Drawings: Emshield WFR2 by Sika Emseal.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 079200 – JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections include the following:

1. Section 042000 – Unit Masonry
2. Various Division 07 Roofing Specifications
3. Section 084113 – Aluminum Entrances and Storefronts
4. Section 084413 – Glazed Aluminum Curtain Walls
5. Section 085113 – Aluminum Windows
6. Section 093013 – Ceramic Tile

1.02 WORK INCLUDED

A. The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, appliances, and materials and performing all operations in connection with the application of caulking complete, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

1. It is the intent of the caulking work under this Section to provide waterproof seals at all joints where shown on drawings.

B. Joint sealants to be as per the exterior and interior joint sealant schedules at the end of this section.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer
2. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
3. ASTM C834 - Specification for Latex Sealants
4. ASTM C 920 - Specification for Elastomeric Joint Sealants
5. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
6. ASTM C 1193 - Guide for Use of Joint Sealants
7. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants
8. ASTM C 1311 - Specification for Solvent Release Sealants
9. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
10. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
11. ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
12. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness
13. ASTM E 283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
14. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

B. NSF International (NSF):

1. Standard 51: Food Equipment Materials

C. Sealant, Waterproofing, and Restoration Institute (SWRI):

1. SWRI Validation Program

1.04 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 - Submittal Procedures, and as modified below.

B. Manufacturer's Data, Sealants and Caulking:

1. Submit three copies of manufacturer's specifications, recommendations, and installation instructions for each type of sealant, caulking compound, and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

C. Samples, Sealants and Caulking:

1. Submit three 12" long samples of manufacturer's standard colors for each type of sealant or caulking compound for selection by Architect.

a. Install sample between two strips of material similar to or representative of typical surfaces where sealant or compound will be used, held apart to represent typical joint widths. Samples will be reviewed by Architect for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

D. Guarantee, Sealants:

1. Submit three copies of written guarantee agreeing to repair or replace sealants which fail to perform as air tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability, or appear to deteriorate in any other manner not clearly specified as in inherent quality of the material by submitted manufacturer's data. Provide guarantee for a period of two years, signed by the installer and Contractor.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Experienced Installer equipped and trained for application of joint sealants required for this Project with record of successful completion of projects of similar scope.

B. Single Source Responsibility: Provide glazing sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

C. Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit [four] samples of each material that will be in contact with or affect joint sealants. Test sealants with substrate materials using ASTM C794 or manufacturer's standard test methods to determine requirements for joint preparation, including cleaning and priming. Test sealants with related materials to verify compatibility.

D. Preconstruction Field-Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C1193 Method A or method recommended by manufacturer. Verify

adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Architect.

E. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.

1.06 WARRANTY

A. Special Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified.

1. Warranty Period for Silicone Sealants: 20 years date of Substantial Completion.

C. Warranty Conditions: Special warranties exclude deterioration or failure of joint sealants in normal use due to structural movement resulting in stresses on joint sealants exceeding sealant manufacturer's written specifications, joint substrate deterioration, mechanical damage, or normal accumulation of dirt or other contaminants.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Provide joint sealant products manufactured by The Dow Chemical Company, Midland MI; (877) SEALANT ((877) 732-5268); email: construction@dow.com; dow.com/construction; or Architect approved equivalent.

2.02 MATERIALS, GENERAL

A. VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Low-Emitting Sealants for Interior Applications: Provide sealants and sealant primers complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, with joint substrates, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer by testing and related experience.

D. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each liquid-applied joint sealant.

E. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested

per ASTM C 1248 as non-staining on porous joint substrates indicated for Project.

F. Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600.

2.03 LIQUID JOINT SEALANTS

A. Joint Sealant #1 – Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T, NT; SWRI validation.

1. Basis of Design Product: DOWSIL™ 790 Silicone Building Sealant.
2. Hardness, ASTM C 661: 15 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 26 g/L maximum.
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's full line of not less than 10 colors.

B. Joint Sealant #2 – Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.

1. Basis of Design Product: DOWSIL™ 756 SMS Building Sealant.
2. Hardness, ASTM C 661: 35 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 60 g/L maximum.
4. Staining, ASTM C 1248: None on white marble.
5. Color: As selected by Architect from manufacturer's full line of not less than 8 colors.

C. Joint Sealant #3 – Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT, G, M and A; SWRI validation.

1. Basis of Design Product: DOWSIL™ 791 Silicone Weatherproofing Sealant.
2. Hardness, ASTM C 661: 34 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 30 g/L maximum.
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's full line of not less than 6 colors.

D. Joint Sealant #4 – Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, A, and O; SWRI validation.

1. Basis of Design Product: DOWSIL™ 795 Silicone Building Sealant.
2. Hardness, ASTM C 661: 35 - 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 32 g/L maximum.
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's full line of not less than 10 colors.

E. Joint Sealant #5 – Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.

1. Basis of Design Product: DOWSIL™ 995 Silicone Structural Sealant.
2. Hardness, ASTM D 2240: 35 - 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 34 g/L maximum.
4. Ultimate Tensile, ASTM C 1135: 160 psi (1.1 MPa), at 21 day cure (TA Joint).
5. Color: As selected by Architect from manufacturer's full line of not less than 3 colors.

F. Joint Sealant #6 – Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SWRI validation.

1. Basis of Design Product: DOWSIL™ 758 Silicone Weather Barrier Sealant.

2. Hardness, ASTM D 2240: 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 61 g/L maximum.
4. Color: White.

G. Joint Sealant #7 – Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Basis of Design Product: DOWSIL™ 999A Silicone Building & Glazing Sealant.
2. Hardness, ASTM D 2240: 25 durometer Shore A minimum.
3. Volatile Organic Compound (VOC) Content: 36 g/L maximum.
4. Ultimate Tensile, ASTM D 412: 325 psi (1.2 MPA) at 21 day cure (Dumbbell).
5. Color: As selected by Architect from manufacturer's full line of not less than 6 colors.

H. Joint Sealant #8 – Mildew-Resistant, Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Basis of Design Product: DOWSIL™ 786 Silicone Sealant.
2. Hardness, ASTM D 2240: 25 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 36 g/L maximum.
4. NSF Standard 51 and FDA Regulation No. 21 CFR 177.2600 compliant.
5. Color: As selected by Architect from manufacturer's standard colors.

I. Latex Joint Sealant: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

J. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.

2.04 PRE-FORM JOINT SEALANTS

A. Preformed Silicone Elastomer Extrusion: Highly flexible low-modulus flashing and transition material for bonding to substrates with silicone sealant. SWRI validation.

1. Basis of Design Product: DOWSIL™ 123 Silicone Seal.
2. Surface: Smooth matte, Textured or Grooved to facilitate bending.
3. Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
4. Hardness, ASTM D 2240: 25 durometer Shore A, minimum.
5. Color: As selected by Architect from manufacturer's full line.

B. Preformed Silicone Elastomer Custom Two- and Three- Dimension Extrusion: Highly flexible flashing and transition material for bonding to substrates with silicone sealant.

1. Basis of Design Product: DOWSIL™ 123 Silicone Seal Custom Design H. C.
2. Formulation: General Purpose or High Tear.
3. Shape: Multi-dimensional as indicated on drawings and approved shop drawings and as required to fit and functionally seal specific application and prevent air and water penetration
4. Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
5. Color: As selected by Architect from manufacturer's full line.

2.05 WEATHER BARRIER TRANSITIONS

A. Silicone Elastomer Weather Barrier Transition: Highly flexible clear flashing and transition strip and pre-molded corners for bonding with silicone sealant to weather barrier substrates and to adjacent curtain wall, storefront, and window frames and other transition substrates.

1. Basis of Design Product: DOWSIL™ 123 Silicone Transition Strip (STS).
2. Hardness, ASTM D 2240: 50 - 60 durometer Shore A.
3. Color: Translucent

4. Air Infiltration, ASTM E 283: Maximum 0.025 cfm/sq. ft. (0.127 L/s per sq. m) at 6.24 lbf/sq. ft. (300 Pa).
5. Water Penetration under Static Pressure, ASTM E 331: None at 15 lbf/sq. ft. (720 Pa)
6. Movement Capability: Not less than plus 200, minus 75 percent.
7. Tensile Strength, ASTM D 412: Not less than 800 psi (5.5 MPa).
8. Tear Strength, ASTM D 624: Not less than 200 psi (16 kN/m).
9. Elongation, ASTM D 412: Not less than 400 percent.
10. Bonding Sealant: Manufacturer's recommended neutral-curing silicone.

2.06 ACCESSORIES

A. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

B. Premolded Joints for Floors and Paving:

1. Rescor Expansion Joint (W. R. Meadows) or approved equivalent, 1/2-inch thick or as shown; leave 1/2-inch clear space at top to receive sealant.

C. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.

1. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

a. Either flexible, open-cell polyurethane foam or non-gassing, closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.

2. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to -26°F (-15°C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

D. Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back of joint.

E. Primer: As recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with joint sealant work once conditions meet sealant manufacturer's recommendations.

3.02 PREPARATION

A. Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer.

1. Remove laitance, form-release agents, dust, and other contaminants.
2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.

3.03 SEALANT APPLICATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

C. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

D. Joint Backing: Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.

   1. Install bond breaker tape over substrates when sealant backings are not used.

E. Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.

   1. Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.

   2. Using tooling agents approved by sealant manufacturer for application.

F. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.

   1. Remove masking tape immediately after tooling joint without disturbing seal.

   2. Remove excess sealant from surfaces while still uncured.

3.04 PREFORMED JOINT SEALANT APPLICATION

A. Preparation: Prepare surfaces in accordance with sealant manufacturer's written instructions. Perform field adhesion testing to determine need for application of primer. Clean surfaces to dust free, and perform solvent wipe where recommended. Mask edges of surface to be treated.

B. Application: Apply bead of recommended liquid joint sealant to each side of joint in bead size recommended by manufacturer. Press extrusion into sealant using roller to ensure uniform and complete contact. Lap vertical and horizontal joints as indicated in manufacturer's instructions. Trim preformed joint sealant. Remove masking tape and excess sealant.

3.05 WEATHER BARRIER TRANSITION APPLICATION

A. Preparation: Prepare field of weather barrier surface and surface of adjacent substrate in accordance with sealant manufacturer's written instructions. Perform field adhesion testing to determine need for application of primer. Clean surfaces to dust free, and perform solvent wipe where recommended.

B. Application: Apply bead of recommended liquid joint sealant to each side of joint in bead size recommended by manufacturer. Press transition extrusion into sealant using roller to ensure uniform and complete contact. Lap vertical and horizontal joints as indicated in manufacturer's instructions. Trim transition material. Remove excess sealant.

3.06 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer's instructions and with ASTM C 1193, Method A.

1. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate, and one test for each 1000 feet of joint length thereafter or 1 test per each floor per building elevation, minimum.

2. For sealant applied between dissimilar materials, test both sides of joint.

B. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

C. Submit report of field adhesion testing to Architect indicating tests, locations, dates, results, and remedial actions taken.

3.07 EXTERIOR JOINT-SEALANT SCHEDULE

A. Exterior construction joints in cast-in-place concrete.

1. Joint Sealant #1: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

B. Exterior movement joints in concrete unit masonry.

1. Joint Sealant #4: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

C. Exterior movement joints in brick masonry.

1. Joint Sealant #4: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

D. Exterior movement joints in stone masonry.

1. Joint Sealant #2: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

E. Exterior joints within exterior insulation finish systems (EIFS).

1. Joint Sealant #1: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

F. Exterior exposed joints in metal panel cladding systems.

1. Joint Sealant #2: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

G. Exterior concealed watertight joints in cladding systems.

1. Joint Sealant #3: Single-component neutral-curing silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

H. Exterior joints between different materials listed above.

1. Joint Sealant #4: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.
3. Multiple colors required to match several conditions.

I. Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.

1. Joint Sealant #4: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.
3. Multiple colors required to match several conditions.

J. Exterior joints within aluminum storefront framing, curtain walls, and window systems.

1. Joint Sealant #4: Single-component neutral-curing non-staining silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

K. Exterior joints within structural glazing and protective glass sealant.

1. Joint Sealant #5: Single-component, nonsag, neutral-curing silicone sealant.

L. All other exterior non-traffic joints.

1. Joint Sealant #1: Single-component neutral-curing silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

M. Exterior horizontal traffic and traffic isolation joints.

1. Joint Sealant #1: Single-component pourable silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

3.08 INTERIOR JOINT-SEALANT SCHEDULE

A. Interior movement joints in exterior concrete and unit masonry.

1. Joint Sealant #4: Single-component neutral-curing silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

B. Interior perimeter joints of exterior frames.

1. Joint Sealant #3: Single-component neutral-curing silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

C. Interior movement joints in interior unit masonry.

1. Joint Sealant #4: Single-component neutral-curing silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

D. Interior perimeter joints of interior frames.

1. Joint Sealant #3: Single-component neutral-curing silicone sealant.
2. Color: As selected by Architect from manufacturer's full range.

E. Interior sanitary joints between plumbing fixtures and food preparation fixtures and casework and adjacent walls, floors, and counters.

1. Joint Sealant #8: Mildew-Resistant, Single-Component, nonsag, acid-curing silicone joint sealant.
2. Color: As selected by Architect from manufacturer's full range to match multiple conditions.

F. Interior traffic joints in floor and between floor and wall construction.

1. Joint Sealant #1: Single-component, nonsag, neutral-curing silicone joint sealant.
2. Color: As selected by Architect from manufacturer's full range.

G. Interior non-moving joints between interior painted surfaces and adjacent materials.

1. Joint Sealant: Siliconized acrylic latex.
2. Color: White; paintable.

H. Interior concealed sealants at thresholds and sills.

1. Joint Sealant: Butyl-rubber-based joint sealant.

I. Interior exposed and non-exposed acoustical applications.

1. Joint Sealant: Acoustical sealant specified in Section 079219 Acoustical Joint Sealants.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 079219 – ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

1.02 DEFINITIONS

A. Acoustic Joint Sealant: “Acoustic Joint Sealant or Spray: Material or combination of materials used to achieve specified acoustical rating of non-fire-rated assembly by providing an effective barrier against sound transmission through construction joint and through penetration openings.”

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested acoustic systems shall be used in specific locations as follows:

1. Top and bottom of gypsum board partitions.
2. Top of masonry walls.
3. Through-penetrations in gypsum and masonry walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 033000 – Concrete
2. Section 042000 – Unit Masonry
3. Section 078443 – Joint Firestopping
4. Section 079200 – Joint Sealants
5. Section 092900 – Gypsum Wall Board

1.05 REFERENCES

A. Test Requirements:

1. ASTM C734, Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
2. ASTM C834, Standard Specification for Latex Sealants
3. ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications
4. ASTM D217, Standard Test Methods for Cone Penetration of Lubricating Grease
5. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
7. ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
8. ISO 11600, Building construction -- Jointing products -- Classification and requirements for sealants

1.06 QUALITY ASSURANCE

A. Installing contractor shall arrange for the acoustic joint sealant manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of acoustic sealant and spray systems to train appropriate contractor personnel in proper selection and installation procedures.

B. Acoustical sealants shall be installed per manufacturer's written recommendations published in their literature and drawing details.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including documentation of STC testing and manufacturer's installation instructions in accordance with Section 013300.

B. Submit material safety data sheets provided with product delivered to job-site.

C. VOC Content Limitations: Submit documentation of conformance with LEED EQ Credit 4.1 “Low-Emitting Materials, Adhesives, and Sealants.”

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the acoustic sealant and acoustic spray manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its acoustical sealant products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of acoustical sealants after completion of gypsum wall board but prior to covering or concealing of joints.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of acoustical sealant materials when temperatures are outside the manufacturers recommended limitations.

E. During installation, provide masking and drop cloths to prevent acoustical sealant materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 ACOUSTICAL SEALANTS

A. Acoustic Sealant for Exposed and Concealed Joints and annular spaces around through-penetrations: Provide manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C834, ASTM C919 and the following:

1. Sealant effectively reduces airborne sound transmission through head-of-wall and bottom-of-wall joints and openings to accommodate through-penetrations in building construction as demonstrated by testing representative assemblies in accordance with ASTM E90.
2. Acoustical Sealant to maintain STC ratings at sound rated partitions as indicated on the drawings.
3. Sealant has flame-spread and smoke-developed ratings of less than 25 as tested in accordance with ASTM E84.
4. Sealant is mold and mildew resistant per ASTM G21 with a rating of zero (0), "no growth".
5. Sealant has movement capability of minimum 12.5% in accordance with ISO 11600. Latex sealant according to ASTM C 834 class OP -18°C with shrinkage according to ASTM C 1241 < 25 % C.
6. Proposed acoustic sealant materials and methods shall conform to applicable governing codes having local jurisdiction.

2.02 ACOUSTICAL SPRAYS

A. Acoustic Spray for exposed and concealed joints: Provide manufacturer's standard sprayable latex material complying with ASTM C919 and the following:

1. Spray effectively reduces airborne sound transmission through head-of-wall joints in building construction as demonstrated by testing representative assemblies in accordance with ASTM E90.
2. Acoustical Spray to maintain STC ratings at sound rated partitions as indicated on the drawings.
3. Spray has flame-spread and smoke-developed ratings of less than 25 as tested in accordance with ASTM E84.
4. Spray is mold and mildew resistant per ASTM G21 with a rating of zero (0), "no growth".
5. Spray has movement capability of minimum 12.5%.
6. Proposed acoustic spray materials and methods shall conform to applicable governing codes having local jurisdiction.

2.03 MANUFACTURERS

A. Basis of Design: Hilti, Inc., Plano, Texas, 800-879-8000, www.us.hilti.com.

2.04 MATERIALS

A. Products: Subject to compliance with requirements, provide the following:

1. Hilti CP 506 Smoke and Acoustic Sealant
2. Hilti CP 572 Smoke and Acoustic Spray
3. Hilti CP605 bottom of wall sealant

2.05 ACCESSORIES

A. Pre-formed mineral wool:

1. CP 767 Speed Strips
2. CP 777 Speed Plugs

B. Mineral wool

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify acoustic joints are properly sized and in suitable condition for application of materials.

2. Surfaces to which acoustic sealant and spray materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by acoustic sealant and spray materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of acoustic sealant and spray.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Comply with acoustic sealant and spray manufacturer’s written installation instructions for products and applications indicated.

B. Standards: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

C. Install acoustic sealant backings of type indicated to support sealant and spray during application in accordance with manufacturer’s written installation instructions.

D. Install acoustic sealant and spray free of air pockets, embedded foreign matter, sags and ridges.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess acoustic sealant from surfaces adjacent to joint.
2. Remove excess acoustic spray from surfaces adjacent to joint as indicated on the drawings.
3. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
4. Provide concave joint configuration per Figure 8A in ASTM C1193, unless otherwise indicated.

3.03 FIELD QUALITY CONTROL

A. Examine acoustic joints and penetrations to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturer of acoustical joint sealants.

B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

3.05 PROTECTION

A. Protect acoustic joints during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Contract Completion.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 079513 – EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General conditions, Supplementary Conditions, and Division 01 – General Requirements apply to work of this section.

1.02 WORK INCLUDED

A. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

1. Interior wall expansion joint covers.
2. Interior floor expansion joint covers.
3. Interior ceiling expansion joint covers.

1.03 SYSTEM DESCRIPTION

A. Joint covers shall permit unrestrained movement of the joint, without disengagement of the cover. Joint movement to be as follows:

1. Floor Expansion Joints: Approx. 50% overall movement.
2. Flush Wall & Ceiling Expansion Joints: Approx. 25% overall movement.
3. Surface Mount Wall & Ceiling Expansion Joints: Approx. 100% overall movement.
4. Acoustical Ceiling: Approx. 100% overall movement.

1.04 RELATED WORK

A. Related work specified under other specification sections of the specification:

1. Section 033000 – Cast-in-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 051200 – Structural Steel
4. Section 054000 – Cold Formed Metal Framing
5. Section 092300 – Gypsum Plaster
6. Section 092900 – Gypsum Wall Board
7. Section 095000 – Acoustic Ceiling Systems
8. Section 096519 – Resilient Tile Flooring
9. Section 096800 – Carpeting

1.05 DEFINITIONS

A. Nominal Joint Width: The width of the expansion joint opening as specified in the project documents, at which the expansion joint will be constructed and the cover will be installed.

B. Maximum Joint Width: The widest expansion joint width which the joint cover is required to accommodate without damage to its components.

C. Minimum Joint Width: The narrowest expansion joint width which the joint cover is required to accommodate without damage to its components.

D. Movement Capability: The amount of movement in a single direction (open or close), given as a percentage of the nominal joint width, that the joint cover is required to accommodate without damage to its components.

E. Lateral Shear: Movement horizontally and parallel to the expansion joint.

F. Vertical Shear: Movement vertically and parallel to the expansion joint.

1.06 QUALITY ASSURANCE

A. Standards:

1. Provide prefabricated expansion joint covers by a single firm specializing in the production of the type of work required, so that there will be undivided responsibility for the specified performance of all component parts.

2. Materials criteria shall comply with ASTM B 221, *Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.*

3. Fire rated joint covers shall have been tested by an independent, nationally recognized testing and listing entity in accordance with ANSI/UL No. 263, ASTM E119, UL 2079, or ASTM E1966, including hose stream test, where applicable, at the full rated period. Covers shall be listed with an independent, nationally recognized testing and listing entity. Fire rating shall be required when covers are applied to fire rated construction, and shall be not less than the fire rating of adjacent construction.

B. Manufacturer:

1. Obtain joint cover assemblies through one source from a single manufacturer.

2. Manufacturer shall have a third party certified ISO 9001 quality management system.

a. The manufacturer shall have documented management and control of the processes that influence the quality of its products.

b. The manufacturer shall have documented management and control of the processes that influence the quality of its customer service.

3. Manufacturer shall have a minimum of ten (10) years of experience in the fabrication of expansion joint cover assemblies.

C. Installer:

1. Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

2. All products listed in this section shall be installed by a single installer with demonstrated experience in installing products of the same type and scope as specified. Installer shall be insured and licensed as required by agencies within the project’s jurisdiction.

1.07 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Manufacturer's Data - Prefabricated Joint Covers:

1. Submit manufacturer’s specifications and technical data, including Material Safety Data Sheets, installation instructions, and, as required, catalog cuts and templates to explain construction and to provide for incorporation of the product into the project.

2. Submit certificates, copies of independent test reports, or research reports showing compliance with fire resistance rating and other specified performance requirements.

C. Shop Drawings:

1. Submit detailed shop drawings showing complete fabrication details for all joint covers, including required anchorage to surrounding construction, recesses, blocking, backing and connections between similar and dissimilar joint cover assemblies.

D. Samples:

1. Submit three (2) 6” samples of the specified system.

2. Two (2) complete sets of color chips representing manufacturer’s full range of available colors and patterns.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in their original, unopened packages or containers with all labels intact and legible.

B. Store all materials in a single location protected from weather, moisture, and open flame or sparks.

C. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of other trades.

1. Provide temporary protective cover on anodized aluminum, stainless steel, and bronze finished surfaces.

D. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

1.09 MANUFACTURER’S INSTRUCTIONS

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work, including preparation of substrate, applying materials and protection of installed units.

1.10 WARRANTY

A. Submit manufacturer’s warranty that materials furnished will perform as specified for a period of not less than one (1) year when installed in accordance with manufacturer’s recommendations.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. To establish a level of quality, details and specifications have been based on the following products by Balco, Inc., P.O. Box 17249, 2626 S. Sheridan, Wichita, Kansas, 67217; phone” 800-767-0082 or (316) 945-9328; fax: (316) 945-0789, or architect approved equivalent.

2.02 EXPANSION AND SEISMIC JOINT SYSTEMS

A. Floor Joint Covers:

1. No-Bump Floor-to-Floor System (Models NBAF-.5-1 and NBAF-2) at locations as indicated on the Contract Drawings.

2. No-Bump Floor-to-Wall System (Models NBAFL-.5-1 and NBAFL-1-2) at locations as indicated on the Contract Drawings.

3. Surface Floor-to-Floor System (Models 75FPE-1 and Model 75FPE-2) at locations as indicated on the Contract Drawings.

4. Surface Floor-to-Wall System (Models 75FVPE-1 and Model 75FVPE-2) at locations as indicated on the Contract Drawings.

5. Surface Floor-to-Floor System for Tile Flooring (Models 75FTE-1 and Model 75FTE-2) at locations as indicated on the Contract Drawings.

6. Surface Floor-to-Wall System for Tile Flooring (Models 75FVTE-1 and Model 75FVTE-2) at locations as indicated on the Contract Drawings.

B. Wall and Ceiling Joint Covers:

1. Surface Mounted Gypsum Board Walls and Ceiling Systems (Models 75FWG-1, 75FWG-2, 75FWGC-1, and 75FWGC-2) at locations as indicated on the Contract Drawings.

2. Flush Mounted Gypsum Board Walls and Ceiling Systems (Models 6GW-1, 6GW-2, 6GWC-1, and 6GWC-2) at locations as indicated on the Contract Drawings.

C. Wall Joint Covers:

1. Surface Mounted Masonry Wall Systems (Models 75FWPE-1, 75FWPE-2, 75FWVPE-1, and 75FWVPE-2) at locations as indicated on the Contract Drawings.

D. Ceiling Joint Covers:

1. Vinylines Series for Acoustical Ceilings (Models AC-1, AC-2, ACL-1 and ACL-2) at locations as indicated on the Contract Drawings.

2.03 MATERIALS

A. Metals:

1. Aluminum extrusions: ASTM B221, alloys 6063-T5, 6005A-T6, 6061-T6.
2. Aluminum plate and sheet: ASTM B209, alloys 6061-T6, 5052-H32.
3. Steel: ASTM A36 Plate.
4. Stainless steel: ASTM A666, type 304.

B. PVC Vinyl: 90 Shore A, ASTM D2240 - Extruded flexible wall and ceiling joint cover.

C. Silicone: ASTM D 2000 4GE 709 M - extruded elastomeric flat seal.

D. Santoprene:

1. 75 shore A durometer, 15 sec, ISO 868.

2. Face Seals to be installed in exterior conditions shall be UV resistant.
3. Colorable extruded wall and ceiling joint cover system face seals.
4. Neutral extruded wall and ceiling joint cover system back seals.

E. Abrasive: Two (2) part Epoxy combined with aluminum oxide grit.

F. Water Barrier: Flexible EPDM, Class I, ASTM D4637, 45 mils thick (minimum).

G. Fire Barriers: Designed for indicated or required dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Tested in maximum joint width condition with a field splice as a component of an expansion joint cover by an independent, nationally recognized testing entity in accordance with UL 2079, or ASTM E1966, including hose stream test, where applicable, at the full rated period. Assemblies shall be listed with an independent, nationally recognized testing and listing entity.

H. Standard fasteners, accessories and other materials required for complete installation in accordance with the manufacturer's instructions shall be included.

I. All surfaces in contact with masonry or concrete shall be protected by a factory-applied coating.

2.04 FABRICATION

A. Fabricate expansion/ seismic joint cover assemblies as detailed. Provide centering bars, sealing washers, gaskets, splice covers, and closures as necessary for complete installation.

1. Fabricate special transitions and corner fittings as required.
2. Fabricate fire barrier and provide fire-resistant sealant as required for fire-resistant installations.
3. Miter and weld joint systems as applicable.
4. Provide necessary and related parts, devices, anchors, form clips and other items required for water-resistant and fire-resistant installation.
5. Provide corners, tees, transitions, curb risers, etc. assembled with connection mitered and secured to ensure proper fit and alignment as applicable.
6. Special conditions shall be shop fabricated.
7. Cover plates shall have a smooth surface for walls and v-grooved for floors or as indicated on the drawings.

B. Shop assemble components and package with anchors and fittings. Provide components in single lengths where possible; minimize site splicing.

2.05 FINISHES

A. Aluminum:

1. Floors:
   a. Mill finish extrusions, AA-M10, unless otherwise indicated.
   b. Mill finish plate, AA-M30, unless otherwise indicated.

2. Interior Walls and Ceilings: (as selected by Architect)
   a. Clear anodized, Class II, AA-M12 C22 A31.
   b. Color anodized, Class II, AA-M12 C22 A34.
   c. Fluorocarbon coating: Two-step "Kynar" fluorocarbon coating: 0.2 – 0.4 mil. prime coat, min. 1.0 mil baked finish coat as selected by the Architect.

B. Stainless Steel: Satin finish.

1. Floors: Directional textured finish.

2. Interior walls: #3 Finish.
3. Exterior walls: #3 Finish.

C. Vinyl: Gray (color for floor and walls) and white (color for ceilings).

D. Santoprene: Color as selected by Architect.

E. Abrasive: Black or as selected by Architect.

F. Filler Strips: Gray or as selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements [and blockout dimensions] are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.

B. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by the manufacturer for achieving the required results within project conditions.

B. Corner blockouts should be square, level, free of spalling or laitance, and meet the dimensions shown on shop drawings. Repairs should be made using appropriate materials as recommended by concrete repair material manufacturer, based on project-specific conditions.

C. Concrete repair material must be applied and allowed to cure in accordance to the manufacturer of the product recommendations and instructions.

D. Clean dirt, debris, and other contaminants from both the blockout and joint opening.

E. Mask areas adjacent to the joint as required to achieve neat, clean joint lines. Remove masking prior to the curing process.

3.03 INSTALLATION

A. Install joint covers in accordance with the manufacturer’s instructions and true alignment. Set floor covers flush with adjacent finished floor materials. Locate wall and ceiling covers in continuous contact with adjacent surfaces. Securely attach in place with all required accessories. Locate anchors approximately 3" from each end 12" o.c. between ends for set screws, and 18" o.c. between ends for other fasteners, unless closer spacing is recommended by the manufacturer. Make allowances for change in joint size due to difference between installation and building operating temperatures.

B. Set centering bars diagonally at 20 inches on center maximum. Centering bars shall be fully engaged with the base members.

C. Hold end joints to the minimum, make end joints with strong rigid mechanical splice plate in the alignment with hairline joints.

D. Locate fasteners at interval recommended by manufacturer as shown on shop drawings.

E. Floor systems: Where shimming is required, provide continuous support for base members to prevent vertical deflection when in service.

F. Heavy-duty floor systems: Repair or grout blockouts as required for continuous frame support. Bring base members to proper level; shimming is not allowed.

G. Fire-rated joint covers: Install fire rated covers in accordance with requirements of applicable fire rated product. Install fire barriers and flame sealant as shown on shop drawings and in accordance with installation instructions.

H. Water barrier: Install water barriers at exterior joints and where called for on shop drawings. Provide drainage fittings where called for on shop drawings.

I. Remove strippable protective coating; leave all exposed metal surfaces clean.

3.04 ADJUSTING AND PROTECTION

A. Adjust joint cover to freely accommodate joint movement.

B. Protect installation from damage by work of other Sections.

C. Where required, remove and store cover plate and install temporary protection over joints; reinstall cover plate before completion of work.

D. Do not remove protective coverings until finish work in adjacent areas is complete.

E. Prior to project closeout, clean exposed surfaces with a suitable cleaner as recommended by manufacturer.

3.05 WARRANTY

A. The Contractor shall guarantee all workmanship and material in accordance with the General Conditions and Section 017000.

END OF SECTION

DIVISION 08 – OPENINGS

081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Standard and custom hollow metal doors and frames as indicated and scheduled on drawings.
B. Steel sidelight, borrowed lite and transom frames.
C. Acoustical Rated Doors
D. Louvers installed in hollow metal doors.
E. Light frames and glazing installed in hollow metal doors.
F. Factory finishing hollow metal doors and frames.
G. Items specified elsewhere:

1. Finish hardware is specified elsewhere in Division 8.
2. Building in of anchors and grouting of frames in masonry is specified in Division 04.

1.03 RELATED SECTIONS

A. Section 042000 – Unit Masonry
B. Section 081416 – Flush Wood Doors
C. Section 081433 – Stile and Rail Doors
D. Section 087100 – Door Hardware
E. Section 088000 – Glazing
F. Section 088813 – Fire Rated Glazing
G. Section 088853 – Security Glazing
H. Section 099000 – Painting
I. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
J. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.

1.04 REFERENCES

A. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
E. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
F. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
G. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
H. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

I. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
J. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Doors Under Specified Pressure Differences Across the Specimens.
K. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
L. ASTM E 413 - Classification for Rating Sound Insulation.
M. ANSI/ASA S12.60 – Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools
N. ASTM E1332 - Standard Classification for Determination of Outdoor-Indoor Transmission Class.
O. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
P. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
Q. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
R. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
T. NFRC 102 – Procedure for Measuring the Steady State Thermal Transmittance of Fenestration Systems.
U. NFRC 400 – Procedure for Determining Fenestration Product Air Leakage.
V. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
W. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.05 SUBMISSIONS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems
9. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
10. Indicate coordination of glazing frames and stops with glass and glazing requirements.

D. Samples: Full range of color samples for Architect selection; 2 samples, 6" square minimum, of each color and texture selected for factory finished doors and frames.

E. Label Construction Certification: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, submit manufacturer's certification for that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal doors and frames from an SDI Certified manufacturer. www.steeldoor.org/sdicertified.php

B. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

C. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to UL10C or NFPA 252 at positive pressure (neutral pressure at 40" above sill).

1. Oversize Fire-Rated Door Assemblies: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from an approved independent testing and inspection agency, indicating that door and frame assembly conforms to the requirements of design, materials, and construction as established by individual listings for tested assemblies.

2. Temperature Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

3. Smoke Control Door Assemblies: Comply with UL 1784 and NFPA 105.

    a. Smoke "S" Label: Doors to bear "S" label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

F. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.

1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements.

    a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.29, R-Value 3.4, including insulated door, thermal-break frame and threshold.

2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements.

    a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

G. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor

to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

D. Store doors and frames at building site under cover. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately.

2. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.09 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Products shall be manufactured by a member of the Steel Door Institute or an architect approved equivalent. Steel Door Institute Members are as follows:

1. Steel Doors and Frames, (General):

a. Curries.

b. Ceco Door.
c. Deansteel Manufacturing Co.
d. DCI Hollow Metal.
e. Hollow Metal Xpress.
f. Mesker Door, Inc.
g. MPI.
h. Pioneer Industries, Inc.
i. Premier Steel Doors and Frames.
j. Republic Doors & Frames.
k. Security Metal Products Corp.
l. Steelcraft.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

E. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

F. Finish: Provide prefinish doors unless otherwise indicated, provide manufacturer's electrostatic paint finish. All other doors to be finished as described in Division 09 - Section 099000.

2.03 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.

1. Design: Flush panel.

2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.

   a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.

   b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, Mercury thermal-break frame and threshold.

3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16

gauge (0.053-inch - 1.3-mm) thick steel, Model 2.

4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9”.

7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.

   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.

3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.

4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Simulated Woodgrain Embossed Steel Doors: Similar or equal to GrainTech Series as manufactured by Steelcraft, a division of Allegion, PLC, 11819 N. Pennsylvania Street, Carmel, IN 46032; tel. (888) 925-2171. Where so noted in door schedule, provide CE Series embossed steel panel doors featuring deep-embossed panels that create the appearance of wood grained doors; 16 gauge hollow metal door units, in 1-3/4” thickness in sizes as indicated on the doors schedules. All doors shall comply with 1.06 “Quality Assurance” of this specification section, similar to standard steel doors. All Grain-Tech doors shall carry a minimum fire rating of 1 hour, unless otherwise indicated on door schedules.

E. Finished Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.

F. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

G. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware," published by Door and Hardware Institute.

H. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

I. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

J. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

K. Apply finish coat to doors indicated as prefinished by electrostatically spraying and baking, to produce a paint thickness of 1.25 mils.

2.04 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated:

1. Blade Type: Vision proof inverted V or inverted Y.

2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.

2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.07 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lights where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lights each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lights in Doors and Loose Stops for Glazed Lights in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.08 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.09 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.

2. Glazed Lights: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

3. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.

4. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

6. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

8. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".

9. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".

    a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
    b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
    c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
    d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.

10. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

11. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    c. Three anchors per jamb up to 60 inches high.
    d. Four anchors per jamb from 60 to 90 inches high.
    e. Five anchors per jamb from 90 to 96 inches high.
    f. Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    g. Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

12. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

13. Frame Undercoating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water-based frame undercoating or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware;

include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250 specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Remove weld slag and spatter from exposed surfaces. All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces. On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer. Primer shall be fully cured prior to shipment.

B. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

C. Factory Pre-Finished: Factory apply electrostatic paint finish to doors and frames in accordance with ANSI A250.3 test procedure acceptance criteria for steel doors and frames with factory applied finished coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified. Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Grout shall be mixed to provide a 4 inch (102 mm) maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors in accordance with NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-

inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

D. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

E. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and incomplete and proper operating conditions.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 081416 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The extent and location of each type of wood door is shown on drawings and schedules.

B. The types of doors required include the following:

1. Factory-finished solid core flush wood doors, with wood-veneer faces.
2. Fire rated flush wood doors.
3. Acoustic (STC) rated wood doors.
4. Matching interior wood frames.

C. Related Sections:

1. Section 081113 – Hollow Metal Doors and Frames.
2. Section 087100 – Finish Hardware.
3. Section 088000 – Glass and Glazing.
4. Section 099000 – Painting.

D. Related Documents: Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

A. It is the intent of the specification that all wood doors shall comply with the standards as listed. The latest published edition of each standard applies.

B. WDMA Interior Architectural Wood Flush Doors Standard.

1. ANSI/WDMA I.S. 1A-21

C. Building Code References.

1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.
2. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies.
3. NFPA 101 – Life Safety Code.
4. IBC – International Building Code.
5. 2020 Building Code of New York State.
6. New York State Education Department Manual of Planning Standards, Section S109
7. UL 10B-Standard for Fire Tests of Door Assemblies (neutral pressure).
8. UL 10C-Standard for Positive Pressure Fire Tests of Doors.
9. Intertek Warnock Hersey-Listed Product and Code Compliance Directory.
10. QAI Laboratories-Listing Directory for Building Products.
11. ADA Standards for Accessible Design (Current Edition).
12. California Air Resource Board (CARB) –formaldehyde emissions standard.
13. Consumer Products Safety Commission (CPSC) 16 CFR 1201 – Standard for Architectural Glazing

1.03 SUBMITTALS

A. Comply with the requirements of Section 013300 – Submittal Procedures, and as modified below.

B. Manufacturer's Data:

1. Submit manufacturer's product data, specifications, and installation instructions for each type of wood door required. Data shall include details of core and edge construction and trim for openings. Include factory-finishing specifications.

2. Submit manufacturer's certificate indicating that doors and louvers meet, or exceed, requirements of indicated fire rating.

C. Shop Drawings: Submit three samples, minimum 12" x 12", showing veneer, core, and edge construction for each type of wood door required. Indicate location, size, and hand of each door, elevation of each kind of door, construction details not covered in Product Data; location and extent of hardware blocking and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

D. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of Factory-Finished Doors: Show the full range of options available for stained and transparent finishes.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Frames for light openings, 6 inches long, for each material, type and finish required.

1.04 QUALITY ASSURANCE

A. In addition to the requirements shown on the drawings and specified in this section, comply with the following standards:

1. NFPA 80 "Standard for Fire Doors and Windows' of the National Fire Protection Association.

2. NWWDA “Guide to Door Face Veneers”.

B. Source Limitations: Obtain flush wood doors through one source from a single manufacturer with a minimum of 10 years’ experience.

1. Provide AWI Quality Certification Labels, or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows," and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard

Methods of Fire Tests of Door Assemblies" & NFPA 252 “Standard Methods of Fire Tests of Door Assemblies” of the National Fire Protection Association by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg. F maximum in 30 minutes of fire exposure.

D. ASTM E119 “Standard Test Methods for Fire Tests of Building Construction Materials”.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard, manufacturer’s written instructions and the WDMA – Appendix Section – “Care and Installation at Job Site”.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheet.

C. Protect wood doors during transit, handling, and storage to prevent damage, soiling, and deterioration. Store inside building in a dry location and stack in accordance with manufacturer's instructions.

D. Mark each door on top and bottom rail with opening number used in shop drawings.

E. Provide protective coverings for shop finished doors at the factory prior to shipping. Use heavy paper cartons and mark with identification required for proper installation.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity at occupancy levels during remainder of construction period.

1.07 MANUFACTURER WARRANTY

A. Submit three copies of written agreement in door manufacturer's standard form signed by the manufacturer, installer, and Contractor agreeing to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup or twist) more whan ¼ inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

B. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

C. Warranty shall be in effect during the following period of time from date of Substantial Completion.

1. Solid-Core Interior Doors: Life of Installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: The design for flush wood doors is based on Aspiro™ Series, Marshfield-Algoma

by Masonite Architectural, 877.332.4484, masonite.com/architectural/products/aspiro-series specified to indicate requirements for quality and appearance. Subject to compliance with requirements, provide the named product or a comparable product such as the following:

1. VT Industries, Holstein, Iowa.

2.02 MANUFACTURING STANDARDS

A. Interior Flush Wood Doors: Window & Door Manufacturers Association publication ANSI/WDMA I.S. 1A-21 “Industry Standard for Interior Architectural Wood Flush Doors”.

B. Fire-Rated Wood Doors: Conforming to NFPA 80; listed and labeled for required ratings based on testing at positive pressure NFPA 252 or UL 10C by UL or other testing agency acceptable to authorities having jurisdiction.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 250 deg F above ambient after 30 minutes of standard fire-test exposure.

2. Blocking: Provide composite blocking approved for use in doors of fire-protection ratings indicated as needed to maintain WDMA performance level and eliminate through-bolting hardware.

3. Vertical Edge Construction:

   a. Category A Positive Pressure: Integral intumescent seals concealed by outer stile where required.

4. Pairs: Formed-steel edges and astragals with intumescent seals as required for ratings.

   a. Steel edges and astragals with baked enamel in color selected by Architect from manufacturer’s standard offering.

C. Acoustical Rating for Solid Core Doors: Where indicated in door schedule on Drawings, provide STC, as indicated on drawings, doors supplied with seals and gaskets tested by manufacturer.

2.03 INTERIOR SOLID CORE FLUSH WOOD DOORS

A. Basis of Design: Aspiro™ Series | Marshfield-Algoma™ by Masonite Architectural.

B. Solid Core Select Wood Veneer Flush Doors

1. WDMA Quality grade: Premium

2. WDMA Performance Level: Extra Heavy Duty

3. Faces:

   a. Veneer Grade: A
   b. Veneer Species: White Oak or Maple; as selected by Architect.
   c. Veneer Cut: Plain Sliced
   d. Veneer Leaf Match: Book Match
   e. Veneer Face Match/ Assembly: Center-balance

4. Pair Match: Provide for doors hung in same opening or separated only by mullions.

5. Vertical Edges: Structural Composite Lumber Matching/Compatible Veneer edge band over structural composite lumber.

6. Horizontal Edges: Structural composite lumber.

7. Core: Structural composite lumber (SCLC).

8. Construction: Five Plies; stiles and rails bonded to core, and entire unit is abrasive planed before veneering.

9. Thickness: 1-3/4 inch.

C. Solid Core Select Wood Veneer Flush Doors with Glazed Lites

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.

2. Glazing: Refer to Specification Section 08800 – Glazing.

3. Metal Glazing Frames: Manufacturer's standard frame formed of 0.048-inch thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish.

   a. Frame Design: Metal Vision Frame 110 for standard vision lite.
   b. Frame Design: Metal Vision Frame 115-L1 for insulated glass.

D. Solid Core Select Wood Veneer Flush Doors with Louvers

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.

2. Metal Louvers: 600A1; Paint finish in color selected by Architect from manufacturer’s standard colors.

E. Fire-Rated Select Wood Veneer Flush Doors

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.

2. Category A positive pressure.

3. Core:

   a. 20-Minute Doors: Structural composite lumber core.
   b. 45-Minute Doors: Mineral core with blocking options.
   c. 60-, 90-Minute Doors: Mineral core with blocking options.

      1) Blocking Options: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated:

         a) 5-inch top-rail blocking.
         b) 5-inch bottom-rail blocking.
         c) 5-inch mid-rail blocking with 5-by-10-inch lock blocks.

4. Vertical Edges:

   a. 20-Minute Doors: Matching 1/8 inch high impact edge bonded to structural composite

lumber.

b. 45-, 60-, 90-Minute Mineral Core Doors: Matching 1/8 inch (3.2mm) high impact edge bonded to structural composite lumber.

5. Horizontal Edges:

a. 20-Minute Doors: Structural composite lumber.
b. 45-, 60-, 90-Minute Doors: Manufactures standard construction per label service listing.

F. Fire-Rated Select Wood Veneer Flush Doors with Glazed Lites

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.

2. Glazing: Refer to Specification Section 088813 – Fire Rated Glazing.

3. Metal Glazing Frames: Manufacturer's standard frame formed of 0.048-inch thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish.

a. Frame Design: Metal Vision Frame 110 for standard vision lite.
b. Frame Design: Metal Vision Frame 115-L1 for insulated glass.

G. Fire-Rated Select Wood Veneer Flush Doors with Louvers

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.

2. Louvers for fire-rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

3. Metal and Finish: 18 gauge cold rolled steel, with manufacturer's standard color baked-enamel- or powder-coated finish.

2.04 ACOUSTIC (STC) RATED INTERIOR FLUSH WOOD DOORS

A. Acoustic Rated Interior Flush Wood Doors

1. Match appearance grade and applicable construction and performance requirements of other standard veneer flush solid core wood doors.

2. STC Ratings: Certified by manufacturer on basis of testing per ASTM E90 and E413. Rating requirements are stated in the door schedule on the Drawings.

3. Provide gasketing and mortise door bottom as required to meet manufacturers tested acoustic rating.

B. Coordination: STC-Rated Doors: Where installed in hollow metal frames, fill frames with compressed mineral wool insulation.

2.05 DOOR CORE MATERIALS

A. Structural Composite Lumber: WDMA T.M.10.

2.06 TRANSPARENT FINISH WOOD DOORS FRAMES

A. Provide wood door frames where indicated on the drawings and schedules.

B. Material: Solid lumber that matches species of door veneer.

C. Frame Profile: Custom double rabbet.

D. Trim: Solid lumber that matches species of door veneer.

E. Trim Stile: Colonial Casing, Contemporary Casing, Sleek Casing or Traditional Casing as indicated on the drawings and selected by Architect.

F. Fire Rating: Match rating of door.

2.07 FABRICATION

A. Door Pairs:

1. Veneer Matching: Running match.

B. Transoms and Side Panels: Same construction as adjacent doors.

1. Transom Veneer: Continuous match.

C. Factory Fitting: Fit to frame openings with clearances specified in WDMA I.S. 1A.

1. Comply with clearance requirements of referenced quality standard for fitting.

2. Undercut: Maximum 3/8 inch above thresholds.

3. Fire-Rated Doors: Comply with NFPA 80.

a. In accordance with NFPA-80, Section 1-7, Glazing Material, Fire protection rated glazing (vision panels) must be installed in approved steel frames.
b. Glazing for openings through doors, such as ceramic fire rated safety glass, shall be fitted into trim openings and well embedded in putty.

D. Factory Machining: Machine doors for hardware that is not surface applied.

1. Verify dimensions for hardware mortises in metal frames before machining.

2. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

3. Metal Astragals: Pre-machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

E. Openings:

1. Cut and trim openings at factory.

2. Cut openings and install louvers at factory.

F. Exterior Doors:

1. Treat with water-repellent preservative per WDMA I.S.4.

2. Flash tops of outswinging doors with stainless steel.

G. Contractor Option: Doors supplied with wood frames may have hardware installed at factory:

H. Door Frames:

1. Supply frames with temporary spreader bars at base.

2.08 FINISHES

A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.

B. Finish all door surfaces at factory.

C. Finish Grade: Match grade of door

D. Transparent: WDMA TR-8, UV-Cured Acrylated Polyester/Urethane.

1. Staining: Standard color selected by Architect or custom color to match Architect's sample when noted on the Drawings.

2. Sheen: Satin.

E. Restore finish on all edges of shop-finished doors before installation.

F. Drips and runs of paint, stain, primer, or sealer are not acceptable.

2.09 FIRE RATED DOORS

A. Comply with applicable requirements of AWI 1300 and NFPA 80 "Standard for Fire Doors and Windows" for fire ratings indicated on drawings and in schedule.

B. Provide doors which have been tested and rated by Underwriter's Laboratories, Inc. (UL) for the fire ratings and class indicated in the schedule using single-point hardware.

1. Attach UL classification Marking label indicating door type, rating, class, and temperature rise to edge of each fire-rated door.

C. Provide veneer and finish to match non-fire-rated doors in the same area of building, unless otherwise indicated.

D. Door assemblies in corridors and smoke barriers shall be tested in accordance with NFPA 252 or UL 10C.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames prior to hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.

2. Inspect each door before installation for damage and defects per WDMA Section F-6.

B. Proceed with installation, only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.

B. Fit doors to frames and machine for hardware.

3.03 INSTALLATION

A. Reference Standards:

1. Wood Doors: WDMA I.S. 1A.
2. Fire-Rated Doors: NFPA 80.
3. Smoke-and Draft-Control Doors: NFPA 105.

B. Install wood doors in accordance with manufacturer's instructions. Adjust for proper fit, uniform clearance at each edge, and smooth balanced door movement. For installation of finish hardware, refer to Section 087100 – Door Hardware.

C. Provide clearance for doors of 3/32" at jambs and heads and 3/8" at bottom, unless otherwise indicated.

1. For fire rated doors, provide clearances complying with the limitation of the authority having jurisdiction. Install fire-rated doors into corresponding fire-rated frames, according to NFPA 80.

2. Allow extra clearance as required for thresholds, carpet, and similar materials.

D. Job-fitted use: Align and fit doors in frames with a uniform clearances and bevels as indicated below. Do not trim stiles and rails in excess of limits set by the manufacturer or permitted for fire-rated doors. Machine doors for hardware; seal cut surfaces after fitting and machining.

E. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.

F. Comply with NFPA 80 for fire-rated doors.

G. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

H. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

I. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.04 ADJUSTING & REPAIR

A. Operation: Re-hang or replace doors what do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with the requirements and shows no evidence of repair or refinishing.

C. Repair of damage or defects is subject to Architect’s acceptance, including removal of soiling. Provide new replacement doors for doors that cannot be satisfactorily repaired.

3.05 PROTECTING AND CLEANING

A. Protect installed doors from damage and soiling during construction.

B. Clean doors shortly before inspection for Substantial Completion.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 083300 – ROLLING COUNTER FIRE SHUTTERS

PART 1 - GENERAL

1.01 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section Includes: Automatic closing rolling counter fire doors with integral frame and countertop.

C. Related Sections:

1. Section 055000 – Metal Fabrications - Door opening jamb and head members.
2. Section 061000 – Rough Carpentry - Door opening jamb and head members.
3. Section 099000 – Painting
4. Division 26 – Electrical wiring and conduit for connection to alarm system.

D. Products That May Be Supplied, But Are Not Installed Under This Section:

1. Control Station
2. Key test station
3. Annunciator

E. Scope of work:

1. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

   a. Roll-up coiling overhead fire shutter (1 1/2-hour – UL listed) in location indicated on drawings.
   b. All operators, controls, hardware, weatherstripping, etc., required for a complete installation.

2. Related work to be performed under other sections or contracts:

   a. All electrical connections, wiring, etc. – See Division 26 – Electrical.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements:

1. All rolling counter fire doors shall be constructed in accordance with testing agency requirements and shall bear a 1-1/2 hour rating label.

1.03 SUBMITTALS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below:

1. Product Data

2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.

3. Quality Assurance/Control Submittals:

   a. Provide manufacturer ISO 9001:2015 registration.
   b. Provide manufacturer and installer qualifications.
   c. Provide manufacturer's installation instructions

4. Closeout Submittals:

   a. Operation and Maintenance Manual.
   b. Certificate stating that installed materials comply with this specification.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years experience in producing rolling counter fire doors with integral frames of the type specified.

2. Installer Qualifications: Manufacturer's approval.

1.05 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in their original, unopened packages or containers with all labels intact and legible.

B. Store all materials in a single location protected from weather, moisture, and open flame or sparks.

C. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of other trades.

D. Follow manufacturers requirements.

1.06 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design Manufacturer: Cornell – 24 Elmwood Avenue, Mountain Top, PA 18707. Telephone: (800) 233-8366, www.cornelliron.com, or Architect approved equal.

2.02 PRODUCT INFO

A. Model: ERC20

2.03 MATERIALS

A. Curtain:

1. Slat Configuration: (Finish as noted on drawings or as selected by Architect)

a. Galvanized Steel with Finish as Described Below: No. 10 (1-1/4” high by 3/8” deep) interconnected flat-faced slats constructed of 22 gauge, ASTM A 653, Commercial Quality, galvanized steel with tubular steel bottom bar measuring 2” high by 1-1/4” deep.
b. Stainless Steel: No. 10 (1-1/4” high by 3/8” deep), interlocked flat-faced slats constructed of 22 gauge AISI type 304 #4 finish stainless steel with tubular stainless steel bottom bar measuring 2” high by 1-1/4” deep.

2. Finish:

a. SpectraShield® Coating System (Color Selected by Architect):

1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat.
2) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.

b. Stainless Steel: type 304 #4 finish.

B. Endlocks: Fabricate continuous interlocking slat sections with high strength galvanized steel endlocks riveted to slat ends per UL requirements.

C. Head and Jamb Frame: Integral welded with guide groove incorporated into jamb design. Build to fit wall thickness as indicated on the drawings.

1. Stainless steel: 16 gauge; type 304 #4 finish.

D. Countertop:

1. Stainless steel: 14 gauge; type 304 #4 finish.

E. Counterbalance Shaft Assembly:

1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.

2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Provide wheel for applying and adjusting spring torque.

F. Brackets: Fabricate from reinforced AISI 300 series stainless steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures for hood.

1. Finish:

a. Stainless Steel: type 304 #4 finish

G. Hood and Fascia:

1. Finish: 16 gauge steel or 16 gauge stainless steel, as selected by Architect, with reinforced top

and bottom edges

a. Stainless Steel: type 304 #4 finish

2.04 OPERATION

A. AlarmGard Series Electric Tube Motor: UL, cUL listed NEMA 1 enclosure, 115v/ 60 Hz/ single phase service. Provide a totally enclosed non ventilated motor, removable without affecting the setting of limit switches; thermal overload protection, planetary gear reduction, adjustable rotary limit switch mechanism and a transformer with 24v secondary output. All internal electrical components are to be prewired to terminal blocks.3548:

1. Provide a failsafe tubular motor operated fire shutter assembly requiring no ancillary or externally mounted release devices, cables, chains, pulleys, reset handles or mechanisms.

2. Provide an internal electrical failsafe release device that requires no additional wiring, external cables or mounting locations.

3. Provide an internal solenoid brake mechanism to hold the door at any position during normal door operation.

4. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, constant rate viscosity, oscillation type or other exposed governing devices.

5. Electrically activate door system automatic closure by notification from local detectors.

6. Maintain automatic closure speed at not more than 12” per second.

7. Enable safety edge function during alarm gravity closing while power is present. Enable door to rest upon obstruction following this sequence.

8. Electrically reset internal failsafe release device and door operating system upon restoration of electrical power and upon clearing of the alarm signal without requiring human supervision.

9. Provide selectable ability for the door system to automatically self-cycle to the fully open position following automatic reset without requiring human supervision.

10. Ensure that manual resetting of spring tension, release devices, linkages or mechanical dropouts will not be required.

11. Notify electrical contractor to mount control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the door system wiring instructions.

12. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80 Section 5.

B. Control Station:

1. Flush mounted: "Open/Close/Stop" push buttons; NEMA 1B.

C. Control Operation:

1. Momentary contact to close: Fail-safe, UL325-2010 Compliant Entrapment Protection for Motor Operation.
   a. Smartsync Wireless Edge Kit – continuously monitored, wireless sensing/weather edge

seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Wireless edge kit will use Zigbee wireless technology. Radio band wireless sensing edges will not be permitted.

2.05 ACCESSORIES

A. Locking: Padlockable slide bolt: Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides. Provide interlock switches on motor operated units.

B. Photoelectric Smoke/Heat Detector: UL listed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

A. General: Install door unit and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

B. Comply with NFPA 80 and follow manufacturer's installation instructions.

3.03 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.04 FIELD QUALITY CONTROL

A. Site Test: Test doors for normal operation and automatic closing. Coordinate with authorities having jurisdiction to witness test and sign Drop Test Form.

3.05 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.06 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.

B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 084113 – ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 SUMMARY

A. This Section covers the following:

1. Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

2. Aluminum Entrances, Aluminum Thermal Entrances, FRP Entrances, glass and glazing, and door hardware and components.

B. The extent of aluminum entrances and frames is shown on the drawings.

C. Related work specified elsewhere:

1. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
2. Section 079200 – Joint Sealants
3. Section 084413 – Glazed Aluminum Curtain Walls
4. Section 085113 – Aluminum Windows
5. Section 085659 – Aluminum Voice Around Transaction Security Window
6. Section 087100 – Door Hardware
7. Section 088000 – Glazing
8. Section 281500 – Integrated Access Control Hardware Devices

1.03 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.04 ALUMINUM STOREFRONT SYSTEMS PERFORMANCE REQUIREMENTS

A. General Performance:

1. Provide aluminum entrance and storefront systems to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of aluminum storefront systems representing those indicated for this project.
2. Aluminum storefront systems shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Failure includes any of these events:
   a. Air infiltration and water penetration exceeding specified limits.
   b. Thermal stresses transferring to building structure.
   c. Glass breakage.

d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

4. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Delegated Design:

1. Design aluminum storefront systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads:

1. Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of the 2020 International Building Code or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent. Refer to drawings for Wind Design Data.
2. Test Pressure: 150 percent of inward and outward wind-load design pressures.
3. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

D. Air Leakage:

1. The test specimen shall be tested in accordance with ASTM E 283.
2. With interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.2 psf (300 Pa).
3. Without interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 1.6 psf (75 Pa).
4. CSA A440 Fixed Rating.

E. Water Resistance:

1. Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20% of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:
   a. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
   b. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.

F. Uniform Load:

1. A static air design load of 35 psf (1680 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330.
2. There shall be no deflection in excess of L/175 of the span of any framing member.
3. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
4. Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
5. Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads

indicated without failure of materials or permanent deformation.

G. Seismic:

1. When tested to AAMA 501.4, system must meet design displacement (elastic) of 0.010 x the story height and ultimate displacement (inelastic) of 1.5 x the design displacement.
2. Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.
3. Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

H. Thermal Movements:

1. Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
   a. 0°F to 180°F maximum change (range) in ambient and surface temperatures.
   b. 75°F test interior ambient air temperature.
2. Test performance shows no buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.

I. Thermal Transmittance (U-Factor):

1. Thermal transmittance test results are based upon 1" (25.4 mm) clear high-performance insulating glass [1/4" (e=0.035, #2), 1/2" warm edge spacer and argon fill gas, 1/4"].
2. When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
   a. Glass to Exterior – 0.38 (low-e) BTU/hr/ft2/°F.
   b. Glass to Center – 0.38 (low-e) BTU/hr/ft2/°F.
   c. Glass to Interior – 0.38 (low-e) BTU/hr/ft2/°F
3. Entrance Door Thermal Transmittance Coefficient (U-factor): When tested to ASTM C236 and AAMA Specification 1503, the conductive thermal transmittance (U-factor) shall not be more than 0.61 BTU/hr/sf/°F

J. Solar Heat Gain Coefficient (SHGC):

1. The glazing solar heat gain coefficient (SHGC) shall not be more than 0.36.

K. Condensation Resistance Factor (CRF):

1. The glass to exterior CRF, when tested to AAMA Specification 1503, shall not be less than 70_{frame} and 69_{glass} (low-e) or 69_{frame} and 58_{glass} (clear).
2. The glass to center CRF, when tested to AAMA Specification 1503, shall not be less than 62_{frame} and 68_{glass} (low-e) or 63_{frame} and 56_{glass} (clear).
3. The glass to interior CRF, when tested to AAMA Specification 1503, shall not be less than 56_{frame} and 67_{glass} (low-e) or 54_{frame} and 58_{glass} (clear).

L. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC):

1. Sound transmission loss test results in accordance with AAMA 1801 are based upon 1" (25.4 mm) clear double laminated insulating glass with PVB interlayer (1/8", 0.030", 1/8", 1/2" AS,

1/8", 0.030", 1/8).
2. The glass to exterior ratings, when tested to ASTM E1425 and ASTM E90, shall not be less than STC 38 and OITC 31.
3. The glass to center ratings, when tested to ASTM E1425 and ASTM E90, shall not be less than STC 37 and OITC 30.
4. The glass to interior ratings, when tested to ASTM E1425 and ASTM E90, shall not be less than STC 38 and OITC 30.

M. Impact Resistance Performance:

1. The test specimen shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
2. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
3. Small-Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.

N. Glazing:

1. Physically and thermally isolate glazing from framing members.
2. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.

O. Structural Silicone-Sealant Joints: Provide systems with structural silicone-sealant joints complying with the following requirements:

1. Must comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.
2. Tensile or shear stress in joints is less than 20 psi.
3. Structural sealant withstands tensile and shear stresses imposed by storefront systems without failing adhesively or cohesively. When tested for adhesive compatibility with each substrate and condition required, provide sealant that fails cohesively before it fails adhesively. Adhesive and cohesive failure are defined as follows:
   a. Adhesive failure occurs when sealant pulls away from a substrate cleanly, leaving no sealant material behind.
   b. Cohesive failure occurs when sealant breaks or tears within a joint but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

1.05 ALUMINUM FRAMED ENTRANCE ADDITIONAL PERFORMANCE REQUIREMENTS

A. General Performance:

1. Aluminum-framed entrance system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Air Infiltration:

1. For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf (75 PA) for single and pairs of doors. A single 3'0" x 7'0" (915 mm x 2134 mm) entrance door and frame shall not exceed 1.0 cfm/ft2. A pair of 6'0" x 7'0" (1830 mm x 2134 mm) entrance doors and frame shall not exceed 1.0 cfm/ft2.

C. Structural Performance:

1. Corner strength shall be tested per the Kawneer dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity. Testing procedure and certified test results available upon request.

D. Thermal Performance: (Insulclad™ Thermal Entrances)

1. Computer simulation testing shall be in accordance with NFRC 100/200/500 and AAMA 507-03.

1.06 FLUSHLINE FRP DOORS PERFORMANCE REQUIREMENTS

A. General Performance:

1. Aluminum-framed flush entrance system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283.

C. Uniform Load:

1. The test specimen shall be tested in accordance with ASTM E 330.
2. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

D. Energy Efficiency:

1. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
   a. Aluminum-Framed Flush Entrance Doors with glass lites – with FRP Panel = 0.66.

E. Solar Heat Gain Coefficient (SHGC):

1. Provide entrances with a SHGC minimum and maximum range of:
   a. Aluminum-Framed Flush Entrance Doors with 1/4 Vision Lite – with FRP Panel = (0.03 – 0.12) determined according to NFRC 200 procedures.

F. Visible Transmittance (VT):

1. Provide entrances with a VT minimum and maximum range of:
   a. Aluminum-Framed Flush Entrance Doors with 1/4 Vision Lite – with FRP Panel = (0.01 – 0.09) determined in accordance with NFRC 200 procedures.

G. Impact Resistance Performance:

1. The test specimen shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
2. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.

H. Forced Entry:

1. Tested in accordance with AAMA 1304.

I. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:

1. Flame Spread: Maximum of 200, Class C.
2. Smoke Developed: Maximum of 450, Class C.

J. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:

1. Flame Spread: Maximum of 25.
2. Smoke Developed: Maximum of 450.

K. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 14.0 foot-pounds per inch of notch.

L. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 13,000 psi.

M. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

N. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.

O. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.

P. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 5420: 120 in-lb.

Q. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

R. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

S. Chemical Resistance, ASTM D 543. Excellent rating.
1. Acetic acid, Concentrated.
2. Ammonium Hydroxide, Concentrated.
3. Citric Acid, 10%.
4. Formaldehyde.
5. Hydrochloric Acid, 10%
6. Sodium hypochlorite, 4 to 6 percent solution.

T. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.

U. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.

V. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.

W. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.07 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit manufacturer's construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes and installation instructions for components of

aluminum door and frame assemblies required for the project.

2. Maintenance Manual: Submit three copies of bound maintenance manual for aluminum door and frame assemblies, including manufacturer's product literature on all components and manufacturer's instructions for cleaning, repair, and general maintenance of all components.

C. Shop Drawings:

1. Submit shop drawings for the fabrication and installation of aluminum entrance assemblies and associated components of the work. Include plans, elevations, sections, details of components, provisions for expansion and contraction, attachments to other work, operational clearances and installation details. Show anchors, hardware, operators, and other components not included in manufacturer's standard data, including glazing details. Include hardware schedule and indicate operating hardware types, quantities, and locations.

2. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project. Include structural calculations required to show compliance with wind pressure loading requirements, deflection requirements, and movements in the work.

a. Shop drawings must be signed and sealed by NYS licensed Professional Engineer, who is responsible for the identification of applicable codes and the structural design of the system and anchorage components.

D. Samples:

1. Submit three samples of each required aluminum finish on 12" long extrusions or 6" square sheets of the alloys to be used for the work. Where normal color and texture variations are to be expected, include two or more units in each samples to show the range of such variations. Samples will be reviewed by the Architect for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.

E. Installer Certificates: Submit installer certificates signed by manufacturer, certifying that installers comply with specified requirements.

F. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems. Submit certified test reports showing compliance with specified performance characteristics for framing and door components. Provide tests reports certified with an ICC-Evaluation Service Test Report for FRP doors when required.

G. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

H. Entrance Door Hardware Schedule:

1. Schedule shall be prepared by or under the supervision of supplier.
2. Schedule shall detail fabrication and assembly of entrance door hardware, including procedures and diagrams.
3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.08 QUALITY ASSURANCE

A. The aluminum/FRP doors, frames, and associated work shall be done by a single firm specializing

in the type of work required, so that there will be undivided responsibility for the specified performance of all component parts, including the following:

1. Glazing of aluminum/FRP doors.
2. Installation of all hardware.

B. Details shown are based upon standard details by one manufacturer. It is intended that similar details by other manufacturers will be acceptable, provided they comply with the size requirements, with minimum/maximum profile requirements as shown, and with the specified structural and performance requirements.

C. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

D. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method. Manufacturer must be capable of providing aluminum-framed storefront systems that meet or exceed performance the stated performance requirements. Manufacturer must document this performance by the inclusion of test reports and calculations.

E. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

F. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.

1. Building Enclosure System: When aluminum entrances are a part of a building enclosure system, including entrances, framing, windows, curtain wall system and related products. Provide building enclosure system products from a single source manufacturer.

G. Fabrication Tolerances: Fabricate aluminum entrances in accordance with entrance manufacturer’s prescribed tolerances.

H. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 01 Section "Substitutions."

1. Do not modify size and dimensional requirements.
2. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

I. Preconstruction Sealant Testing: Perform sealant manufacturers' standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by system.

J. Test a minimum of 8 samples of each metal, glazing, and other material.

K. Prepare samples using techniques and primers required for installed systems.

L. Perform tests under environmental conditions that duplicate those under which systems will be installed. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially

formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

M. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with the manufacturer’s ordering instructions and lead-time requirements to avoid construction delays.

B. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle entrance doors and components to avoid damage. Protect entrance doors against damage from elements, construction activities, and other hazards before, during and after entrance installation.

1.11 CLEANING AND PROTECTION

A. The Contractor shall maintain the doors, frames, and side light components in a reasonably clean condition throughout the construction period, so that it will be without any evidence of deterioration or damage (other than the effects of normal weathering) at the time of final acceptance. Select methods of cleaning which will promote the achievement of uniform appearance and stabilized colors and textures for materials that weather or age with exposure.

B. The door installer shall advise the General Contractor to proper and adequate means for protecting portions of the work, which are exposed to likely sources of damage during the remainder of the construction period, including the probable areas of glass breakage.

C. Immediately before the time of final acceptance, the Contractor shall clean the doors thoroughly, inside and out. Demonstrate proper cleaning methods to the Owner's maintenance personnel during this final cleaning. Prepare a "Cleaning and Maintenance Manual" listing the types of cleaning compounds, cleaning methods, and the types of sealants and glazing materials to be used for cleaning, repair, and maintenance of the work.

1.12 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Adhesive sealant failures.

3. Failure of system to meet performance requirements.
4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
5. Failure of operating components to function normally.
6. Water leakage through fixed glazing and frame areas.

Warranty Period: 2 years from date of Substantial Completion. In addition, welded door corner construction shall be supported with a limited lifetime warranty for the life of the door under normal use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. As Basis-of-Design, details and specifications have been based on the following products by Kawneer Company, Inc. 555 Guthridge Court, Technology Park / Atlanta, Norcross, GA 30092 (tel) 770-449-5555; (fax) 770-734-1560:

1. Framing: Trifab® VersaGlaze® 451T Framing System.

    a. 2" x 4-1/2" nominal dimension.
    b. Thermal.
    c. Front, center, back, multi-plane, structural silicone or weatherseal (type B) glazed.
    d. Shear block frame construction.

2. Aluminum Doors: Kawneer Standard Entrance Series

    a. The door stile and rail face dimensions of the 500 Wide Stile entrance door will be as follows:

        1) Vertical stile: 5".
        2) Top rail: 7-1/2".
        3) Optional Cross Rail: 6”.
        4) Optional Bottom Rail: 10”.
        5) Final rail dimensions to be coordinated with construction documents.

    b. Major portions of the door members to be 0.125" (3.2) nominal in thickness and glazing molding to be 0.05" (1.3) thick.
    c. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
    d. Provide adjustable glass jacks to help center the glass in the door opening.

3. Aluminum Doors: Insulclad™ Thermal Entrances Series

    a. The door stile and rail face dimensions of the 560 thermal entrance door will be as follows:

        1) Vertical stile: 5".
        2) Top rail: 7-1/2".
        3) Optional Cross Rail: 6”.
        4) Optional Bottom Rail: 10”.
        5) Final rail dimensions to be coordinated with construction documents.

    b. Major portions of the door members to be 0.125" (3.2) nominal in thickness and glazing molding to be 0.05" (1.3) thick.
    c. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
    d. Provide adjustable glass jacks to help center the glass in the door opening.

4. FRP Doors: Kawneer Flushline™ Entrance Series

    a. The door stile and rail face dimensions of the Flushline™ Entrance door will be as follows:
    b. The door face sheet shall be Pebble textured fiberglass reinforced polyester (FRP) 0.090”.
    c. Vision lites: Aluminum framed vision lite (AVL).
    d. Glass for Visions Lites – Refer to Specification Section 088000.
    e. Vision lite glazing shall be with foam glazing tape.

B. References to named manufacturers shall be construed only as establishing the quality of materials and workmanship to be used under this section, as shall not, in any way, be construed as limiting competition. Products used shall be those upon which the design is based or shall be equal products approved in advance by the Architect. Requests for substitutions will be considered in accordance with provisions of the General Conditions. All permitted equals must be approved in writing by the Architect or Engineer-or-Record. All applications for substitution must include samples and technical data.

C. Substitution Documentation:

    1. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.

    2. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for entrance system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum entrances for a period of not less than ten (10) years.

    3. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.

    4. Product Sample and Finish: Submit product sample, with specified finish and color.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.02 FRAMING MATERIALS

A. Aluminum Extrusions: Framing members, transition members, mullions, adapters, and mountings: Extruded aluminum with alloy and temper as recommended by manufacturer to comply with strength, corrosion resistance and finish requirements, and temper recommended by manufacturer for type of use and finish indicated, not less than 0.070" wall thickness at any location for the main frame, complying with the requirements of standards indicated below.

    1. Sheet and Plate: ASTM B 209.
    2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 - 6063-T6 alloy and temper.
    3. Extruded Structural Pipe and Tubes: ASTM B 429.
    4. Bars, Rods, and Wire: ASTM B 211.
    5. Welding Rods and Bare Electrodes: AWS A5.10.
    6. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.
    7. Glazing as specified in Specification Section 088000 – Glazing.

B. Thermal Barrier: Kawneer IsoLock® Thermal Break with dual nominal 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

C. Screws, miscellaneous fastening devices, and internal components: Stainless steel or plated or corrosion resistant materials of sufficient strength to perform the functions for which they are used. Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials. Where exposed, fasteners and accessories shall be stainless steel. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer. Thermal separators for door cladding shall be rigid polyvinylchloride (PVC) extrusions. Provide adjustable glass jacks to help center the glass in the door opening.

E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

G. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating. Reinforcing members must provide sufficient strength to withstand the design pressure indicated.

H. Structural Silicone Sealant: Type recommended by sealant and system manufacturers that complies with ASTM C 1184 requirements, is compatible with system components with which it comes in contact, and is specifically formulated and tested for use as a structural sealant. Color as selected by the Architect from manufacturer's full range of colors. Tensile Strength: 100 psi minimum. Provide sealant with modulus of elasticity that will not allow movement of more than 25% of joint width, unless less movement is required by structural-sealant-glazed systems' design. Use neutral-cure silicone sealant with insulating-glass units.

I. Secondary Sealant: For use as weatherseal, compatible with structural silicone sealant and other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719. Color as selected by the Architect from manufacturer's full range of colors. Use neutral-cure silicone sealant with insulating-glass units. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

J. Tolerances: References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

K. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.03 FRAMING SYSTEM FABRICATION

A. General: Provide complete aluminum vestibule assemblies, including doors, frames, glass, and related accessories. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings. Fabricate components for shear-block frame construction. Fabricate components for assembly

using manufacturer's standard installation instructions.

1. Fabricate framing member components that, when assembled, have the following characteristics:

    a. Profiles that are sharp, straight, and free of defects or deformations.
    b. Accurately fitted joints that are flush, hairline, and weatherproof.
    c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
    d. Physical and thermal isolation of glazing from framing members.
    e. Accommodations for thermal and mechanical movements of glazing and framing that maintain required glazing edge clearances.
    f. Provisions for field replacement of glazing.
    g. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible

2. Prepare components to receive concealed fasteners and anchor and connection devices.

3. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

4. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

5. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

6. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

7. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

8. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

B. Entrance System Fabrication:

1. Full tubular sections, 2" x 4 ½" nominal dimension; front, center or back fabrication as show in Construction Document details with the following wall thicknesses:

    a. Exposed faces and sides: 3/16" minimum.
    b. Recessed sidewalls receiving mortised or concealed hardware: 1/4" minimum.
    c. Flush glazing pockets: 1/8" minimum.

2. Machine bolt door opening framing components to other framing components and plug holes to match framing finish. Connect framing components functioning as glass holding assemblies with standard frame clips and screws.

3. Provide fully resilient glass settings with moldings and trim inserts not less than 1/16" thick.

C. Mechanically Glazed Framing Members:

1. Fabricate for flush glazing without projecting stops.

D. Structural-Sealant-Glazed Framing Members:

1. Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

2.04 ENTRANCE DOOR MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum-framed entrance door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090” wall thickness at any location for the main frame and door leaf members. Extrusions shall be 6063-T5 alloy and temper (ASTM B 221 alloy G.S. 10A-T5). Major portions of the door stiles shall be .125" thick, and glazing molding shall be .050" thick.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum-framed entrance door members, trim hardware, anchors, and other components. Fasteners, where exposed, shall be aluminum, stainless steel, or plated steel in accordance with ASTM A 164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated. Glazing gaskets shall be elastomeric extrusions.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

2.05 ENTRANCE DOOR FABRICATION

A. Fabricate aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

1. Exposed portions of door cladding moldings shall be 3/32” thick.

2. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, nonferrous shims for aligning system components.

3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Reinforce members as required to retain fastener threads. Arrange for fasteners and attachments to be concealed from view.

4. Do not use exposed fasteners, except for hardware application. For hardware application, use

countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

5. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

6. Concealed Flashing: Dead-soft, 0.018-inch thick stainless steel, complying with ASTM A 666, of type selected by manufacturer for compatibility with system.

B. Fabricate aluminum-framed glass doors that are reglazable without dismantling perimeter framing.

1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.

2. Accurately fit and secure joints and corners. Make joints hairline in appearance.

3. Prepare components with internal reinforcement for door hardware.

4. Arrange fasteners and attachments to conceal from view.

C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details and as follows:

1. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be Kawneer Sealair weathering. This is comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.

2. The door weathering on a double acting, center pivoted door and frame (single or pairs) shall be pile cloth. The meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.

3. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Necessary to meet the specified performance testing).

4. PVC separators shall be applied to the interior side of door structure with screws spaced not more than 9-3/4" on centers. Aluminum cladding shall be interlocked with PVC separators at both edges and mechanically secured to door without adhesives. There shall be no metal to metal contact, direct or indirect, between the cladding or the cladding attachments and the door structure.

5. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

6. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

D. Hardware: Refer to Section 087100 and Door Schedule.

1. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated for all hardware not depicted within hardware sets described within Section 087100. Finish exposed parts to match door finish, unless otherwise indicated.

2. Threshold: Extruded aluminum, one piece per door opening, with ribbed surface.

3. For balance of hardware, refer to Specification Section 087100.

2.06 GLAZING SYSTEMS

A. Glazing to meet requirements in Division 08 Glazing Section. Provide 1” Insulated Glass for exterior applications and 1/4” Tempered Glass for interior applications unless otherwise noted - Refer to Section 088000 for glass types as indicated on drawings.

B. Glazing Gaskets:

1. Manufacturer's standard compression types.
2. Replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks:

1. Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape:

1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants for structural-sealant-glazed systems as recommended by manufacturer for joint type, and as follows:

1. Structural Sealant:

a. ASTM C 1184.
b. Single-component neutral-curing silicone formulation that is compatible with the system components with which it comes in contact.
c. Specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in the aluminum-framed systems indicated.
d. Color: Black.

2. Weatherseal sealant:

a. ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O.
b. Single-component neutral-curing formulation that is compatible with the structural sealant and other system components with which it comes in contact.
c. Recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
d. Color: Matching structural sealant.

2.07 FLUSHLINE™ FIBERGLASS REINFORCED POLYESTER (FRP) DOORS

A. Fabricate aluminum-framed flush entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

1. Material Standard: (ASTM B 221); 6063-T6 alloy and temper.

B. Fabricate aluminum-framed flush entrance doors that are reglazeable, when vision lites are used, without dismantling perimeter framing.

1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" long fillet welds inside and outside of all four corners.

2. Accurately fit and secure joints and corners. Make joints hairline in appearance.

3. Face sheets shall lap and interlock with stile and rails to create a hollow cavity for the froth-in-place urethane core.

4. Prepare components with internal reinforcement for door hardware.

5. Door face sheets shall be embossed fiberglass reinforced polyester (F.R.P.) 0.120" thick.

    a. Pebble texture (FRP) fiberglass reinforced polyester. Color: As selected by Architect.
    b. Door facing to be metal having a minimum thickness of 0.032 inch aluminum or steel having a base metal thickness of not less than 0.016 inch at any point; or must have been tested to perform equivalent to this construction. Provide tests reports certified with an ICC-Evaluation Service Test Report.

6. Interior door face sheets shall have 'Class A' finish.

    a. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.
    b. Flame Spread, ASTM E 84: Maximum of 25.
    c. Smoke Developed, ASTM E 84: Maximum of 450.

7. Aluminum-Framed Flush Entrance Door Core: Shall be urethane foam injected at 5 lb./cu.ft. density and shall have "0" O.D.P. = "Zero" Ozone Depletion Potential and contains no Chlorofluorocarbons (CFC's) or Hydro chlorofluorocarbons (HCFC's).

8. Glass for vision lites to be insulated – See Glass & Glazing Section 088000.

9. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by the Aluminum Association.

10. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.

C. Accessories:

1. Fasteners: Where exposed, shall be Stainless steel.

2. Perimeter Anchors: Aluminum, when steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Hardware: Refer to Section 087100 and Door Schedule

1. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details and as follows:

    a. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be Kawneer Sealair weathering. This is comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.

    b. The door weathering on a double acting, center pivoted door and frame (single or pairs) shall be pile cloth. The meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.

    c. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Necessary to

meet the specified performance testing).

d. PVC separators shall be applied to the interior side of door structure with screws spaced not more than 9-3/4" on centers. Aluminum cladding shall be interlocked with PVC separators at both edges and mechanically secured to door without adhesives. There shall be no metal to metal contact, direct or indirect, between the cladding or the cladding attachments and the door structure.

e. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

f. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

E. FRP Entrance System Fabrication:

1. Top and bottom rails shall be joined to tubular door stiles by mechanical clip fastening and SIGMA deep penetration plug welds and 1-1/8” (29) long fillet welds inside and outside of all four corners. Face sheets shall lap and interlock stiles and rails to create a hollow cavity for the froth-in-place urethane core.

2. Vertical door sections shall be 1-3/4” (45) overall depth with integral reglets to receive and conceal edges of face sheets on both sides of door.

3. Doors shall be reinforced internally to receive surface applied and mortised hardware.

2.08 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Apply the specified finish to visible aluminum surfaces of all aluminum entrance assemblies. Apply a compatible and durable matching finish to visible fasteners or hardware.

2. Prepare the surfaces for finishing in accordance with recommendations of the aluminum producer and the finisher or processor for the specified finish.

3. Three coat process finish on doors and immediate or adjacent frames. Class I, Color Kynar Finish: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA2605. Color as selected by Architect from the full range of industry colors and color densities.

a. Primer coat: Kynar.
b. Kynar finish color coat:

1) Provide Fluoropolymer finish (Kynar 500) based laminated coating similar to "Duranar" (70% PVDF) by PPG Industries.
2) Color as indicated on the drawings or as selected and approved by Architect.

c. Clear coat: One (1) coat clear Kynar protective finish over all painted doors and frames.

4. Contractor to provide and utilize "Air Dry" paint provided by Kawneer to touch up all doors, frames, and ancillary hardware by spray on method.

2.09 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. With installer present, examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. Verify rough opening dimensions.
2. Verify levelness of sill plate.
3. Verify operational clearances.
4. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components for proper water management.
5. Masonry Surfaces:

   a. Masonry surfaces must be visibly dry and free of excess mortar, sand, and other construction debris.

6. Framed Walls:

   a. Framed walls must be dry, clean, sound, well nailed/ screwed, free of voids, and without offsets at joints.
   b. Ensure that nail/ screw heads are driven flush with surfaces in opening and within 3" of opening.

7. Metal Surfaces:

   a. Metal surfaces must be dry and clean (free of grease, oil, dirt, rust, corrosion, and welding slag).
   b. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer’s instructions. Verify openings are sized to receive entrance system and sill is level in accordance with manufacturer’s acceptable tolerances.

C. Field Measurements: Verify actual measurements/openings by field measurements before

fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

A. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions, and manufacturer’s warranty requirements.

B. Comply with the manufacturer's written specifications and recommendations for protecting, handling, assembly and installation of entrance assemblies and other components of the work. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

C. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system and entrance doors, accessories, and other components.

D. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

E. General: Install entrance system in accordance with manufacturer’s instructions and AAMA storefront and entrance guide specifications manual.

F. Set units plumb, level, and true to line, in alignment with established lines and grades, without warp or rack of frames, sash, doors, or panels. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten system to the building structure. Anchor securely in place. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

G. Make suitable provision for thermal expansion in assembly of groups of units. Install components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

H. Set sill member, thresholds, and other members in a full bed of sealant compound as shown or with joint fillers or gaskets as shown to provide weathertight construction, and secure. Comply with requirements of Section 072000 – Joint Sealants.

I. Provide suitable gaskets or coatings where dissimilar metals are in contact. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

J. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible. Adjust doors and hardware to provide a tight fit at contact points and at weatherstripping (if any) for smooth operation and weathertight closure.

K. Clean aluminum surfaces promptly after installation of units. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

L. Where protective coating has been damaged, remove coating completely as soon as the completion of construction activities no longer requires its retention.

M. Install glazing to comply with requirements of Section 088000 – Glazing, unless otherwise indicated.

N. Prepare surfaces that will contact structural sealant according to sealant manufacturer’s written

instructions to ensure compatibility and adhesion.

O. Preparation includes, but is not limited to, cleaning and priming surfaces.

P. Install structural silicone sealant according to sealant manufacturer's written instructions.

Q. Mechanically fasten glazing in place until structural sealant is cured. Remove excess sealant from component surfaces before sealant has cured.

R. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

S. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.

2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.03 FIELD QUALITY CONTROL

A. Field Tests:

1. Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
2. Conduct tests for air infiltration and water penetration with manufacturer’s representative present.
3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
5. Air Infiltration Tests:

    a. Conduct tests in accordance with ASTM E 783.
    b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.

6. Water Infiltration Tests:

    a. After completing the installation of test areas indicated, test storefront system for water penetration according to AAMA 501.2 requirements.
    b. Conduct tests in accordance with ASTM E 1105.
    c. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf.

B. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

C. Manufacturer's Field Services:

1. Upon owner’s written request, provide periodic site visit by manufacturer’s field service

representative.

3.04 ADJUSTING, CLEANING AND PROTECTION

A. Adjusting: Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Protection:

1. Provide final protection and maintain conditions, in a manner acceptable to the manufacturer and installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.
2. Protect installed product’s finish surfaces from damage during construction.
3. Protect aluminum entrances from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
4. Remove and replace damaged aluminum entrances at no extra cost.

C. Cleaning:

1. Clean glass immediately after installation.

    a. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.
    b. Remove non-permanent labels and clean surfaces.

2. Clean aluminum surfaces.
3. Avoid damaging protective coatings and finishes.
4. Remove excess sealants, glazing materials, dirt, and other substances.
5. Repair or replace damaged installed products.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
7. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 085113 – ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of aluminum windows as indicated on the drawings and specified herein. Window shapes and accessories as specified and detailed shall establish the type of units and materials to be used to provide the functional performance and aesthetic requirements desired. Details indicate the required depth and profile. Work shall include, but not necessarily be limited to, the following:

1. Preparation of all rough openings as required to permit proper installation of new aluminum windows and panel systems as shown on drawings and described in the specifications. Note: Remove all sash intact and complete.

2. Removal of existing sash or other existing materials or portions thereof which are required to be removed or altered to permit proper installation of new aluminum windows and panel systems as shown on drawings and described in the specifications.

3. Furnish and install new factory glazed, thermally broken aluminum windows and panels as specified herein, together with all necessary mullion covers, mullions, receptors, filler plates, panning, trim, sheet or plate extrusions for trim, muntins, operating hardware, screens and all other accessories specified herein and/or shown or noted on the drawings, or as required, including anchors, clips, shims, fasteners, drilling, taping and all other activities necessary for the proper installation of the work of this section.

4. Provide .063 extruded aluminum exterior window sills (finish to match window frame specified herein) for all new aluminum windows, except as noted otherwise on the drawings.

5. All window hardware including balances, locks, keepers, poles, hangers, etc.

6. Insulated metal panels and frames as required, or where indicated on drawings.

7. Provide window screens where indicated on drawings.

8. Provide transition membranes at perimeter of window rough openings as indicated on drawings.

9. Insulation against contact of aluminum surfaces with dissimilar metals.

10. Finish on all exposed aluminum surfaces.

11. Installation of new windows, panels, etc. including anchors, clips, shims, blocking, fasteners, drilling, tapping, and all other things necessary for the proper installation of work under this section.

12. Glass and glazing. (Provide insulated glass or insulated panel at all assemblies as indicated on drawings or specified herein).

13. Installation of treated wood blocking, fillers and nailers as required for complete and secure installations.

14. Caulking and sealing of all metal to metal and metal to masonry.

15. Adjustment and servicing of window sash and hardware and replacement of broken or defective parts.

16. Cleaning of aluminum and glazing surfaces.

17. Maintenance, operation and protection.

18. Extra materials as specified or required.

19. Adjustment and servicing of window sash and hardware and replacement of broken or defective parts.

20. Verification of all openings and conditions.

21. Supply and loading of all required containers for storage of all materials and debris, and the legal disposal of all such materials.

B. Related Work Described Elsewhere:

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 072113 – Ultra Wall Insulation and Air Barrier System
4. Section 072713 – Self-Adhered Non-Permeable Air Barrier Membrane
5. Section 079200 – Joint Sealants
6. Section 084113 – Aluminum Entrances and Storefronts
7. Section 088000 – Glazing
8. Section 122400 – Manual Operated Roller Shades

C. Related Documents: Drawings and General Provisions of Contract, including, General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.02 QUALITY ASSURANCE

A. Standards: Comply with the provisions of the standards listed below and the applicable standards listed in Section 014219 (including all revisions of contract to date):

1. Performance class designations according to American Architectural Manufacturers Association (AAMA) Window & Door Manufactures Association (WDMA) and the Canadian Standards Association (CSA) AAMA/WDMA/CSA 101/I.S.2/A440.

   a. AW: Architectural

2. Performance grade number according to AAMA/WDMA/CSA 101/I.S.2/A440.

3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

4. Minimum Test Size: Smallest size permitted for performance class (gateway test size) or as specified elsewhere in this section, whichever is more stringent. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class. Downsized test reports will not be considered acceptable.

5. American Society for Testing and Materials (ASTM):

a. E283: Test for rate of air leakage through exterior windows, curtain walls, and doors.
b. E330: Test for structural performance of exterior windows, curtain walls, and doors by Uniform State Air Pressure Difference.
c. E331: Test for water penetration of exterior windows, curtain walls, and doors by Uniform Static Air Pressure Difference.
d. E547: Test for water penetration of exterior windows, curtain walls, and doors by Cyclic Static Air Pressure Differential.
e. E1996: Glazed opening protection for wind-borne debris shall meet the requirements of the Large Missile Test of ASTM E1996 and ASTM E 1886. Provide glazed windows capable of resisting the large missile impact from windborne debris, based upon pass/fail criteria as determined by testing glazed windows identical to those sizes specified.

   (Note: This is required ONLY for new construction projects whose locations (as indicated) fall within one mile of the coastal mean high water line - any water area experiencing tidal change.)

6. Provide Test Reports from an AAMA approved test laboratory certifying the performance as specified herein. Test reports shall be no more than 4 years old. Test reports based on downsized test units will not be accepted.

7. Test reports shall be accompanied by an AAMA Notice of Product Certification stating that the tested window meets or exceeds the referenced criteria for the AAMA/WDMA/CSA 101/I.S.2/A440.

8. Wind Loads: Provide windows, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of the 2020 International Building Code or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent. Refer to drawings for Wind Design Data.

9. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, "Standard/Specification for Windows, Doors, and Unit Skylights" for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

10. Flat Glass Marketing Association (FGMA): "Glazing Manual".

11. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

B. Product Requirements: For maximum performance, windows for this project must meet both the testing requirements as contained herein and the minimum material requirements specified. Windows that carry the applicable AAMA rating but do not meet the material thicknesses, depths, etc. shall not be acceptable for use on this project.

C. Qualifications of Manufacturer: Provide aluminum windows produced by a single manufacturer regularly engaged in the manufacture of units similar to those required and with a history of successful production acceptable to the Architect.

D. Qualifications of Installers: An installer acceptable to aluminum window manufacturer for installation of units required for this Project shall be provided. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements of the manufacturer's recommended methods of installation needed for proper performance of the work of this section.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum

windows and are based on the specific system indicated. Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Preinstallation Conference: If requested, conduct conference at project site to review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components.

3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.

4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

G. Manufacturer's Certification: Prior to start of installation of the work of this section, secure visits to the job site by a representative of the manufacturer who shall inspect and certify that:

1. The openings in which the work of this section will be installed are all in condition suitable for installation.

2. The materials to be installed comply in all respects with the requirements of this section of these specifications.

3. The materials will be installed in complete accordance with the manufacturer's specifications.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:

1. Horizontal sliding windows. (Test size 99” x 79”)
2. Fixed sash windows. (Test size 60” x 99”)
3. Projected sash windows. (Test size 60” x 144”)
4. Casement sash windows. (Test size 36” x 60”)
5. Single/Double hung windows. (Test size 60” x 99”)
6. Fixed insulating panels.
7. Glass and glazing of aluminum windows; refer to Item 2.02G herein and Specification Section 088000.
8. Caulking between aluminum windows and other materials (interior and exterior).

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units of the minimum test size specified herein that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural and Uniform Load Deflection Tests:

1. Horizontal Sliding Windows:

a. Uniform Load Structural Test: 105 psf (positive and negative).

b. Uniform Load Deflection Test: 70 psf (positive and negative).

2. Fixed Insulated Glazed Windows:

a. Uniform Load Structural Test: 225 psf (positive and negative).
b. Uniform Load Deflection Test: 150 psf (positive and negative).

3. Projected Insulated Glazed Windows:

a. Uniform Load Structural Test: 150 psf (positive and negative).
b. Uniform Load Deflection Test: 100 psf (positive and negative).

4. Casement Insulated Glazed Windows:

a. Uniform Load Structural Test: 210 psf outswing: 150 psf inswing (positive and negative).
b. Uniform Load Deflection Test: 140 psf outswing: 100 psf inswing (positive and negative).

5. Double Hung Insulated Glazed Windows:

a. Uniform Load Structural Test: 150 psf (positive and negative).
b. Uniform Load Deflection Test: 100 psf (positive and negative).

6. Single Hung Insulated Glazed Windows:

a. Uniform Load Structural Test: 165 psf (positive and negative).
b. Uniform Load Deflection Test: 110 psf (positive and negative).

C. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Performance Class and Grade:

a. Horizontal Sliding Windows: AW-PG70
b. Fixed windows: AW-PG150
c. Projected windows: AW-PG100
d. Casement windows: AW-PG140 outswing; AW-PG100 inswing
e. Double hung windows: AW-PG100
f. Single hung windows: AW-PG110

D. Condensation-Resistance Factor (CRF): Provide aluminum windows tested with insulating glass for thermal performance according to AAMA 1503:

1. Horizontal Sliding Windows: Showing a minimum CRF of 57.
2. Fixed Windows: Showing a minimum CRF of 62.
3. Projected Windows: Showing a minimum CRF of 56.
4. Casement Windows: Showing a minimum CRF of 56.
5. Double Hung Windows: Showing a minimum CRF of 50.
6. Single Hung Windows: Showing a minimum CRF of 60.

E. Thermal Transmittance: Provide aluminum windows with whole-window U-factor and SHGC maximums indicated when simulated in accordance with NFRC 100 and NFRC 200 at model sizes shown below and glazed with 1” Argon filled sputter coat Low-E (#2) insulated glass using a warm edge spacer:

1. Horizontally Sliding Windows: (72” x 48”)

a. U-Factor: 0.427 Btu/sq. ft. x h x deg F or less.
b. SHGC: 0.29.

2. Fixed Windows: (47” x 59”)

a. U-Factor: 0.32 Btu/sq. ft. x h x deg F or less.
b. SHGC: 0.33.

3. Projected Windows: (48” x 72” - Fixed/Projected)

a. U-Factor: 0.38 Btu/sq. ft. x h x deg F or less.
b. SHGC: 0.30.

4. Casement Windows: (36” x 60”)

a. U-Factor: 0.40 Btu/sq. ft. x h x deg F or less.
b. SHGC: 0.28.

5. Double Hung Windows: (48” x 72”)

a. U-Factor: 0.38 Btu/sq. ft. x h x deg F or less.
b. SHGC: 0.28.

6. Single Hung Windows: (48” x 72”)

a. U-Factor: 0.38 Btu/sq. ft. x h x deg F or less.
b. SHGC: 0.30.

Note: The thermal resistance (“U”) factor for all insulated glazed window units shall meet or exceed the U values for window units as mandated by the latest version of International Energy Conservation Code adopted by New York State.

F. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Air Infiltration Test:

1. Horizontal Sliding Windows:

a. Maximum Rate: 0.20 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

2. Fixed Windows:

a. Maximum Rate: <0.01 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

3. Projected Windows:

a. Maximum Rate: <0.01 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

4. Casement Windows:

a. Maximum Rate: <0.01 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

5. Double Hung Windows:

a. Maximum Rate: 0.19 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

6. Single Hung Windows:

a. Maximum Rate: 0.24 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

G. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test:

1. Horizontal Sliding Windows:

a. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft.

2. Fixed Windows:

a. Test Pressure: 20 percent of positive design pressure, but not more than 25 lbf/sq. ft.

3. Projected Windows:

a. Test Pressure: 20 percent of positive design pressure, but not less than 20 lbf/sq. ft.

4. Casement Windows:

a. Test Pressure: The lesser of 20 percent of positive design pressure or 25 lbf/sq. ft.

5. Double Hung Windows:

a. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft.

6. Single Hung Windows:

a. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft.

H. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.

I. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA/CSA 101/I.S.2/A440.

J. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for operating window types indicated.

K. All test reports shall be furnished showing compliance to the above performance specifications. Test reports shall not be older than 4 years.

1.04 PROJECT CONDITIONS

A. Field Measurements: Check actual window openings in construction work by accurate field measurement before fabrication of custom window units. Show recorded measurements on final shop drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the

work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. General Contractor shall coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

2. Coordinate fabrication with construction progress to avoid delay.

1.05 SUBMISSIONS

A. General: Before proceeding with the manufacture of windows, the Contractor shall submit complete shop drawings with installation details for the Architect's review and approval. These drawings shall also show window elevations, details of window sections, collateral materials, details of anchorage and associated hardware. Submissions shall be in accordance with Section 013300 – Submittal Procedures, and as modified below.

B. Product Data:

1. Submit manufacturer's product data, include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

2. Maintenance Manual: Submit three copies of bound maintenance manual for aluminum windows, including manufacturer's product literature on all components and manufacturer's instructions for cleaning, repair, and general maintenance of all components.

C. Shop Drawings: Submit shop drawings prepared by window manufacturer for the assembly and erection of the entire window system. Coordinate the submittal of shop drawings for component parts (as specified in other sections) with this transmittal. Show anchorages and alignments not shown on shop drawings of the components. Clearly indicate on all shop drawings all deviations from the Architect's drawings. Include structural calculations required to show compliance with wind pressure loading requirements, deflection requirements, and movements in the work. Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Weather-stripping details.
4. Thermal-break details.
5. Glazing details

D. Samples:

1. Submit three (3) samples of each required aluminum finish on 12-inch long extrusions or 6-inch square sheets. Where normal color and texture variations are to be expected, include two (2) or more units in each sample to shown the range of such variations. Samples will be reviewed by Architect for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.

2. Submit three (3) insulated panel samples comprised and labeled of the specified components and thickness.

E. Submit three (3) insulated glass samples of each type required for the project comprised and labeled of the specified components and thickness.

1. Additional samples, if and as directed by the Architect, to show fabrication techniques, workmanship of component parts and design hardware, and other exposed auxiliary items.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Windows and accessories shall be handled in compliance with AAMA Curtain Wall Manual No. 10, *"Care and Handling of Architectural Aluminum from Shop to Site."*

B. The Contractor shall be responsible for protecting the windows and their finish from damage by the elements, construction activities, and other hazards before, during, and after installation.

1.07 WARRANTY

A. Submit three (3) copies of written warrantee, signed by the Contractor and Manufacturer, agreeing to replace window work which fails in manufacturing, materials or workmanship within ten (10) years of the date of acceptance.

1. Failure of materials or workmanship shall include, but not be limited to:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, or air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of metals or other materials beyond that which is normal.
e. Deterioration of finish or metal in excess of normal weathering
f. Failure of insulating glass.
g. Defects in accessories, weatherstripping, and other components of the work

2. If a defect is found and brought to the attention of the manufacturer, the defect will be corrected at no cost to the Owner. A copy of the manufacturer's warranty shall be provided as a submittal document. Warranty shall not be pro-rated, and the manufacturer shall certify further that replacement parts shall be available for the life of the warranty.

B. Balances: Class 6, Ten years from date of Substantial Completion.

C. Pigmented Organic Coating Warranty: The successful bidder shall certify in writing that the pigmented organic coating on all windows and systems furnished meet the requirements of AAMA 2605 specification for Kynar-based pigmented organic coating and the coating is fully warranted against chipping, peeling, cracking, or blistering for a period of fifteen (15) years and five (5) years for AAMA 2603 from date of installation.

D. Insulated Glass shall be guaranteed against failure for a period of 10 Years from the date of installation.

E. Insulated metal panel shall be warranted by the panel manufacturer for a period of twenty-five (25) years. Panel Finish (Kynar resin-based) shall be guaranteed for a period of twenty (20) years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design is based on use of aluminum window products as manufactured by Architectural Window Manufacturing Corp. 359 Veterans Boulevard, Rutherford, New Jersey, 07070, and the terminology used may include reference to that manufacturer's specific products. Such references shall be construed only as establishing the performance rating, quality of materials and workmanship to be used under this Section and shall not, in any way, be construed as limiting competition.

Bidder's Note: Proprietary assemblies or system components which are the exclusive product or patent of one particular company will not exclude a bidder from proposing alternate products,

assemblies or system components, provided that all required parameters and submissions required of this specification are met and/or exceeded. Operation of units shall not be altered from that as described. Determination of equality shall be the sole decision of the Architect, whose determination shall be deemed final. Manufacturer will have been engaged in aluminum window manufacturing for a minimum of fifteen (15) years.

Similar manufacturers include, but are not limited to:

1. Traco Window Corp., a division of the Kawneer Company, Inc. 71 Progress Avenue, Cranberry Township, PA, 16066, ph. (800) 837-7002.

B. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

C. Window Types:

1. Horizontal Slider Thermally Broken Window:

a. Architectural Window Manufacturing Corp. Series 6700i Horizontal Sliding Double Slide Window
b. TRACO/Kawneer OptiQ AA 5450 Series Horizontal Sliding Window

2. Fixed Thermally Broken Window:

a. Architectural Window Manufacturing Corp. Series 7700i Fixed Window
b. TRACO/Kawneer OptiQ AA 5450 Series Fixed Window

3. Projected/ Casement Outswing Thermally Broken Window:

a. Architectural Window Manufacturing Corp. Series 3042i Projected/Casement Window
b. TRACO/Kawneer OptiQ AA 4325 Series Projected/ Casement Window

4. Double Hung Thermally Broken Window:

a. Architectural Window Manufacturing Corp. Series 4700i Double Hung
b. TRACO/Kawneer OptiQ AA 5450 Series Double Hung Side Load Window

5. Single Hung Thermally Broken Window:

a. Architectural Window Manufacturing Corp. Series 4750i Single Hung
b. TRACO/Kawneer OptiQ AA 5450 Series Single Hung Side Load Window

D. All windows within this project are to be built and supplied by a single manufacturer.

E. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect. Subject to compliance with all material, construction and performance requirements outlined in these specifications. Proof of equivalency is the responsibility of the contractor.

F. Substitutions: Requests for substitutions must demonstrate that the product seeking approval meets or exceeds the design and performance specifications of the named products.

2.02 MATERIALS - All window components shall be AAMA certified materials.

A. Aluminum Extrusions:

1. All frame and sash sections shall be accurately extruded aluminum shapes produced from commercial alloy 6063-T6 and shall be free from defects impairing strength and/or durability. Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.080-inch (1.6-mm) thickness at any location for the main frame and sash members, except the frame sill which shall be a minimum of 0.125-inch.

2. Thermal break: Provide window units with an integrally concealed low conductance structural and mechanical thermal barrier, located between exterior materials and window members exposed on the exterior in a manner that eliminates direct metal to metal contact. The thermal barrier shall be INSULBAR or equal, and consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.

3. Frame, sash, mullion, and sill members shall be of such design and structural strength to satisfy the intended purpose and to meet the applicable AAMA performance requirements. Sill frame shall be constructed of tubular shapes formed from single and continuous extrusions and shall include an aluminum closed weep system to prevent accumulation of water in sill. Products using poured and debridged polyurethane thermal breaks shall not be acceptable.

4. Gaskets: All corner joints of the master frame shall have neoprene compression gaskets to ensure a weather-tight seal.

5. No extruded plastics shall be allowed in the frame or sash members.

6. Exterior and interior frame sill shall have a minimum slope of five (5) degrees.

7. Muntins: Unless otherwise indicated, all muntins for all operational and fixed window units shall be 3/8” deep extruded profile aluminum, frame-mounted and applied to the unit exterior. Muntin colors shall be homogeneous. Pressure-applied muntins shall not be permitted. Windows with exterior applied muntins must utilize integral exterior beveled glazing legs. Products using glazed-in muntin bases will not be acceptable.

B. Fasteners:

1. All screws, nuts, washers, bolts, rivets, and other fastening devices incorporated in the product shall be of sufficient strength and quality to perform their designated function.

2. Fasteners shall be made from aluminum, non-magnetic stainless steel, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

3. Locate all fasteners so as not to disturb the thermal break construction of windows.

4. All fasteners must be concealed except where unavoidable for application of hardware.

5. For application of hardware, where required, use non-magnetic stainless steel phillips machine screws.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Hardware:

1. Hardware shall be of aluminum, stainless steel, or other corrosion resistant materials

compatible with aluminum.

2. Provide one (1) aluminum window operating pole and hanger for each room where new pole operated double-hung and/or project-in windows are installed.

3. Operating sash to have anti-take out (dormitory type) hardware for sash removal by authorized personnel only.

E. Compression-Type Weather Stripping:

1. All sash shall be double weather-stripped using silicone-treated pile with a polypropylene center fin conforming to AAMA 701.2. Provide compressible weather stripping designed for permanently resilient sealing between adjoining window frames and/or perimeter sub-frame conditions under bumper or wiper action and for complete concealment when aluminum window is closed. Weather stripping will be completely sealed when aluminum window is closed and installation is complete.

   a. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440.

F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Double hung and horizontal sliders shall be secured in double rows of extruded ports on sash perimeters. Rigid PVC in one side of vertical stiles and piles, conforming to AAMA 701/702-04, with polypropylene center fin in remaining locations. Projected, secured in extruded ports, double rows of EPDM gasket on vent perimeters.

   a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

G. Glass and Glazing:

1. All lites to be an “insulated glass” system, factory-glazed consisting of:

   a. **Standard Glazing**: Outboard Pane = 1/4” tinted tempered glass with Vitro Solarban 70 coating #2 surface and 1/2” desicant-filled warm edge spacer, with Argon filled void. Inboard Pane = 1/4” tempered glazing, unless otherwise noted within the documents. (Provide obscure glazing at inboard pane at all toilet rooms, locker rooms and where indicated on drawings) Total Thickness: 1”

   Or

   b. **Impact Glazing:** Glazed opening protection for wind-borne debris shall meet the requirements of the Large Missile Test of ASTM E1996 and ASTM E 1886. (Note: This is required ONLY for new construction projects whose locations (as indicated) fall within one mile of the coastal mean high-water line - any water area experiencing tidal change.):

      Outboard Pane = 11/32” tinted annealed laminated glass with .090 PVB interlayer between and 1/2” desicant-filled warm edge spacer, with Argon filled void. Inboard Pane = 1/4” tempered glazing with PPG Solarban 70 Coating on #5 surface, unless otherwise noted within the documents. (Provide white laminated glazing at outboard pane at all toilet rooms, locker rooms and where indicated on drawings) Total Thickness: 1”

2. All windows shall be factory glazed with hermetically sealed insulating glass units with a dual seal of polyisobutylene and silicone. Glass is to be separated by a desicant - filled warm edge

spacer with the void containing Argon Gas. Glass must be set into a continuous bed of silicone sealant and held in place with removable extruded aluminum snap-in beads. Wrap around (marine) glazing, which requires the removal and disassembling of the sash for re-glazing will not be acceptable. Units must be IGCC certified for a CBA rating level.

3. All glass is to be set on 1/4"- inch setting blocks.

4. All glass or panels glazed into window framing shall be bed in structural silicone sealant or receive a perimeter cap bead of silicone sealant between the glazing leg and glass or panel surface. Sealant shall be factory applied.

H. Screens:

1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of window.

2. Screens are to be provided at kitchen areas (food preparation areas), at all administrative areas, at all classroom and instructional locations (excluding rescue windows), and all other operable window locations.

3. Screens shall be provided of manufacturer's standard approved design. Screens are intended to provide reasonable insect control and are not for the purpose to provide security or for the retention of objects or persons from the interior. Screen frame shall match adjacent window frame color and finish.

4. Screening shall be of material compatible with aluminum and conform to USDC CS 138-55, GSA FS RR-W-365, USDC CS 248-64, or GSA FS L-S-125B.

5. Full screens shall consist of 18 x 16 charcoal anodized aluminum mesh secured by vinyl spline to a nominal 5/16" x 1 1/4" x .050 extruded tubular aluminum frame. Frame color and finish to match window system exterior.

6. Screens shall be re-meshable, removable from the interior, and held in place with spring-loaded plungers.

I. Other Materials:

1. Metal Insulated Panels: Insulated metal panels with window frames shall be fabricated with an outer and inner .032 thick, smooth aluminum skin, the outer skin laminated to asbestos-free mineral fiber reinforced cement board, minimum 3/16" thick, and the inner skin laminated to 1/2” thick Type ‘C’ Firecode Gypsum Board to provide a 15 minute interior flame spread rating in accordance with ASTM E-119 and ASTM E-84. The inner core shall be rigid isocyanurate. (Insulation must have a flame spread rating of 0.25 in accordance with ASTM E-84, fuel contribution of less than 100, and smoke developed less than 450.) Total panel thickness shall be 2" or thickness as shown on drawings. Panels shall be manufactured by ‘Mapes Industries’, or as approved equal by the Architect. Aluminum skins shall receive a fluorpon finish (Kynar 500), both exterior and interior faces in colors as selected by the Architect from manufacture’s standard.

2. Sealant: Unless otherwise indicated for sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement. Provide sealant complying with AAMA 800-92.

3. Access Panels: Frames for access panels to be hollow extruded sections, with minimum wall

thickness of 0.062 inches, and shall be miter-cut and assembled with stainless steel screws for ease of repair. Tamper-resistant security fastening shall be installed at the bottom of each panel to securely attach panels to sash. For safety purposes, access panels shall be encased within channels at the top and bottom to prevent the panel from falling out, even if the security fastening is removed.

4. Rescue Labels: Windows designated on drawings as *"Rescue"* or *"Egress"* windows shall meet all applicable codes and shall include a conforming label. Refer to Contract Drawings for additional information.

5. Room number labels shall be provided as noted on the drawings.

2.03 MANUFACTURED UNITS

A. Horizontal Double Sliding Windows: (single slide products will not be acceptable)

1. Dimensions: Minimum .080" wall thickness in all frame, head, and sash extrusions; sill shall be .125" minimum wall thickness high performance sill; not less than 4-1/4" frame and 1-3/4" sash depth; unit height and width as shown on drawings. Sill frame to incorporate a closed weep flap system to allow water out, but prevent air from infiltrating in.

2. Frame Components mechanically fastened. Sash vertical members shall telescope into the sash horizontals and be mechanically fastened. Tubular sash extrusions shall have each corner mitered, reinforced with extruded aluminum corner key, hydraulically crimped, and "cold-welded" with epoxy adhesive.

   a. Mechanical fasteners, welded components, and hardware items shall be located so as to not disturb or bridge the thermal break construction of windows. Thermal barriers shall align at all frame and sash corners. All screws, nuts, washers, bolts, rivets and other fastening devices incorporated in the product shall be of sufficient strength and quality to perform their designated function. Fasteners shall be made from aluminum, non-magnetic stainless steel, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors and other components of window units.

3. Glazing: "Wet glazed" with a silicone back bead compound to be GE SCS-2511 or equal. All lites (both sash and fixed) of the horizontal slider shall be inside glazed. Refer to Item 2.02G herein and specification 088000.

4. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing between adjoining window frames and/or perimeter subframe conditions. Weather stripping will be completely concealed when aluminum window is closed and installation is complete.

   a. Weather-stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/440, similar or equal to *Schlegel "Q-Lon".*

5. Hardware for Horizontal Sliding Windows: Provide the following operating hardware:

   a. General: Provide manufacturer's standard hardware, fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close and securely lock aluminum windows and sized to accommodate sash and ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

   b. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent

sash in direction indicated and operated from the inside only.

c. Sash Rollers: Two tandem Delrin self-lubricating roller assemblies with stainless steel ball-bearing rollers. Sash rollers must be height adjustable with sash in place. Products requiring sash removal to adjust roller height will not be accepted. There shall be a minimum of two (2) rollers per sash.

d. Removable Lift-Out Sash: Design windows whereby both sash operate for ventilation and are removable for cleaning and maintenance, and provide with hardware to permit removal of sash from inside for cleaning.

e. Sill Cap/Track: Extruded-aluminum integral raised track of thickness dimensions, and profile indicated; designed to comply with performance requirements indicated and allow for drainage into the tank and to the exterior through concealed weeps with hinged covers. Raised track must be covered with a stainless steel cap.

f. Roller Assemblies: Low-friction design.

g. Sash Lock: Spring-loaded black zinc die cast plunger lock with black anodized aluminum keeper on meeting rails or Spring-loaded, aluminum snap-type lock at end jamb of exterior sash at jamb. Max. lock height shall be 54” a.f.f.

h. Limit Device: Continuous extruded aluminum sash stop limit device with rubber bumper; for each operable sash; mounted at window sill (excludes rescue windows). Limit dimension to be determined by Architect.

i. Water control, tubular designed sill with removable cover for maintenance, separate and offset weep slots for each track, concealed exterior weep and hinged covers to allow water to drain by gravity and resist wind-driven water.

B. Fixed Windows:

1. Dimensions: Minimum .080" wall thickness in all main frame head and jambs; sill shall be .080" minimum wall thickness; sash extrusions to have minimum wall thickness of .080”; not less than 4-1/4" frame and sash depth; unit height and width as shown on drawings.

2. Frame Components mechanically fastened. Sash vertical members shall telescope into the sash horizontals and be mechanically fastened.

a. Mechanical fasteners, welded components, and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame and sash corners.

3. Glazing: “Wet glazed” with snap-in aluminum extruded glazing bead and PVC bulb; glass set in continuous bead of silicone back bead compound. Refer to Item 2.02G herein and specification 088000.

4. Provide *Schlegel “Fin seal”* or equal.

C. Projected Windows:

1. Dimensions: Minimum 0.080" wall thickness in all frame head and sash extrusions and not less than 4-1/4" minimum frame depth and 3-1/2” minimum sash depth; unit height and width as shown on drawings.

2. Frame Components mechanically fastened. Tubular sash extrusions with each corner mitered,

reinforced with extruded aluminum corner key, hydraulically crimped, and “cold-welded” with epoxy adhesive.

a. Mechanical fasteners, welded components, and hardware items designed to avoid bridging thermal barriers. Thermal barriers shall align at all frame and sash corners.

b. Neoprene weatherstripping, minimum 2 rows, installed in dovetail grooves in sash extrusion of each sash.

3. Glazing: “Wet glazed” with snap-in aluminum extruded glazing bead and PVC bulb interior side; exterior glass set in continuous bead of silicone back bead compound, GE SCS-2511, or equal. Refer to Item 2.02G herein and specification 088000.

4. Hardware for Projected Windows:

a. Hinge: Concealed stainless steel four-bar friction hinge with adjustable-slide friction shoe; two per ventilator.

b. Lock: Cam-action locking handle and keeper (two per ventilator over 42” wide), and spring-loaded catch (with pole ring for gymnasium, kitchen and auditorium windows 72” above the finished floor) and keeper, white bronze with US25D, brushed finish.

c. Limit Device: Integral adjustable stainless steel, stop (two per ventilator).

d. Operating Arms: 4-bar stainless steel arms, similar to *"Anderberg Series 301"*.

5. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable window hardware more than 72 inches (1800 mm) above floor.

D. Casement Windows:

1. Dimensions: Minimum 0.080" wall thickness in all frame head and sash extrusions and not less than 4-1/4" minimum frame depth and 3-1/2” minimum sash depth; unit height and width as shown on drawings.

2. Frame Components shall be mortised and tendon. Tubular sash extrusions with each corner mitered, reinforced with extruded aluminum corner key, hydraulically crimped, and “cold-welded” with epoxy adhesive.

a. Mechanical fasteners, welded components, and hardware items designed to avoid bridging thermal barriers. Thermal barriers shall align at all frame and sash corners.

b. Neoprene weather-stripping, minimum two rows, installed in dovetail grooves in sash extrusion of each sash.

3. Glazing: “Wet glazed” with snap in aluminum extruded glazing bead and PVC bulb interior side. Exterior glass set in continuous bead of silicone backbed compound, GE SCS-2511 or equal. Refer to Item 2.02G herein and specification 088000.

4. Hardware for Casement Windows:

a. Hinge: Aluminum butt hinges painted to match the windows; three per ventilator (four over 60” tall).

b. Lock: One cam-action, white bronze locking handle and keeper (two per ventilator over 42" tall, white bronze with US25D brushed finish. Rescue windows or those where hardware exceeds 72" a.f.f. shall utilize a standard color multi-point with concealed locking points (plus one aluminum pull handle at outswing).

c. Stay Arm: One 90 degrees stainless steel stay arm at windows not utilizing limit devices.

d. Limit Device: Two stainless steel limit arm with key release (Architect to specify clear opening). Cannot be used at rescue windows.

E. Double/Single Hung Windows:

1. Dimensions: Minimum frame and sash extrusions shall have a minimum wall thickness of 0.080". Frame sill members shall have a minimum wall thickness of 0.125". Frame depth shall be 4 ¼" minimum frame depth; 1 ¾" minimum sash depth. Unit height and width as shown on drawings.

2. Frame Components shall be mechanically fastened. Sash horizontal members shall telescope into the sash verticals and be mechanically fastened.

a. Mechanical fasteners, welded components, and hardware items designed to avoid bridging thermal barriers. Thermal barriers shall align at all frame and sash corners.

3. Glazing: "Wet glazed" with snap in aluminum extruded glazing bead and PVC bulb interior side. Exterior glass set in continuous bead of silicone backbed compound, GE SCS-2511 or equal. Refer to Item 2.02G herein and specification 088000.

4. Hardware for Double/Single Hung Windows:

a. Counterbalancing Mechanism: Comply with AAMA 902.

1) Sash Balance: Class 6, concealed Ultralift Extreme spring type capable of lifting 80% of sash weight, of size and capacity to hold sash stationary at any open position.

b. Removable Lift-out Sash: Design windows and provide with hardware to permit removal of sash from inside for cleaning. Units with tilt-in sash will not be acceptable.

c. Handle: Continuous, integral lift rail on bottom rail of lower sash and pull-down rail on top rail of upper sash.

d. Lower Sash Lock: Spring-loaded, snap-type white bronze aluminum lock on bottom rail of lower sash (two if window is greater than 48" wide).

e. Upper Sash Lock: Pole-operated snap type white bronze lock on top rail of upper sash.

f. Limit Device: Continuous approved extruded aluminum sash stop limit device with rubber bumper; for each operable sash located at jamb; two per sash.

g. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches above floor; 1 pole operator and pole hanger per room that has operable window hardware more than 72 inches above floor.

5. Weatherstrip: All primary weatherstrip shall be *Schlegel "Finseal"* or equal.

6. Water control, frame and sill with two weep slots to allow water to drain by gravity and resist

wind-driven water, sash weep holes at bottom of both sash for drainage.

F. Typical for All Windows: Thermal break thermal barriers shall provide a continuous, uninterrupted thermal break around the entire perimeter of the sash and frame, regardless of the operation type.

2.04 FABRICATION

A. General: Provide manufacturer's standard fabrication and accessories which comply with indicated standards and produces units which are reglazable without dismantling of sash framing, except to extent more specific or more stringent requirements are indicated. Include complete system for assembly of components and anchorage of window units and prepare complete preglazing at factory.

B. Sizes and Profiles: Approximate sizes for window units and profile requirements are indicated on the drawings. All sharp milled edges shall be deburred and made smooth prior to finishing. All corner joints shall be joined neatly and sealed with neoprene die-cut compression gaskets in a manner to provide a weathertight connection.

C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance polyamide thermal strut thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.

2. No thermal short circuits shall occur between the exterior and interior.

3. The thermal barrier shall be Insulbar® or equal, and shall consist of two (2) glass reinforced polyamid nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions. Struts shall be a minimum of 34 mm at frames and 24 mm at sash for maximum thermal performance.

4. Poured and debridged urethane thermal barriers shall not be permitted.

D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units. When units occur that are joined by integral mullions, independent mullions, or by a combination of frame members, the resulting members shall be capable of withstanding the design pressure. Evidence of compliance may be by mathematical calculations.

G. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch- thick extruded aluminum. Finish to match window units. Provide subframes capable of withstanding design loads of window units.

H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

I. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

J. Muntins: Where shown on drawings, muntins shall be 3/8” deep profiled extruded aluminum applied to the exterior of nominal 1” deep insulating glass. Roll formed muntins shall not be acceptable. Exterior applied muntins, where applicable, must be pinned to an integral bevel on the frame or sash. Products using applied bevels will not be accepted

K. All frame and sash members are to be continuous extrusions. The window head is to be miter cut and fastened to jambs with 1/8" thick corner keys and 4 cadmium plated or stainless steel screws into integral screw ports. Frame jambs are to be angle cut to match the sill slope and fastened with 4 cadmium plated or stainless steel screws into integral screw ports.

L. The frame sill shall slope 10 degrees to the exterior and contain integral offset weep holes that allow gravity water drainage and resistance to wind driven water and/or air. Provide high performance sill as needed to meet window performance requirements.

M. Each operating sash shall be removable from the interior for cleaning by raising the sash 1” and pulling lower portion to the exterior.

N. All frame joints shall be hairline and be factory sealed with a sealant conforming to AAMA 800-07.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Exterior of Window:

1. The exterior finish shall be: Superior Performance Organic Finish AA-C12C40R1x. Prepare, pretreat and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers written instructions. Fluoropolymer Two-Coat System: Manufacturers standard two-coat thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; complying with AAMA 2605.

2. Optional exterior finish shall be: Superior Performance Organic Finish AA-C12C40R1x. Prepare, pretreat and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers written instructions. Fluoropolymer Two-Coat System: Manufacturers standard two-coat thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat (Sun Storm with mica or metal flake) containing not less than 70% polyvinylidene fluoride resin by weight; complying with AAMA 2605.

D. Interior of Window:

1. The interior finish shall be: Baked Enamel Finish AA-C12C42R1x. Apply baked enamel complying with paint manufacturers written instructions for cleaning, conversion coating and painting. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.

E. Colors: As selected by Architect from manufacturers standard colors or custom color as indicated

on the drawings. Exterior color may be different from interior color.

2.06 ACCESSORIES

A. Casing (Panning):

1. Provide 0.08 inch minimum wall thickness extruded aluminum to cover exterior casings. Aluminum sections shall be of one piece design to lock around the entire window frame for a water-tight connection. Contoured profiles of casing covers shall be as shown on the drawings.

2. The casing covers shall be assembled using stainless steel screws into integral screw ports, with joints back-sealed.

3. Flanged frame, brake metal, exposed fastenings and other alternatives will not be acceptable as a substitution for the specified casing cover system.

B. Exterior Mullion Covers: Exterior mullion covers shall be extruded aluminum shapes. The wall thickness shall be no less than 0.062 inches.

C. Receptors and Sub-Sills:

1. Where indicated on the drawings, extruded aluminum receptors with a minimum wall thickness of 0.94 inches shall be provided at all heads and jambs of the window openings. The base section of the receptor must be secured to the surrounding conditions. The snap-in portion of the receptor must be designed to not require any fastenings.

2. Where indicated on the drawings, extruded aluminum subsills with minimum wall thickness of 0.094 inches shall be provided. Subsills must be designed to able to drain any water that enters the window system by way of weep slots with hinged covers. All subsills are required to have end damns and must be sealed watertight.

D. Interior Trim: Interior trim, closures and angles shall be as shown on the drawings and of aluminum extruded shapes. Minimum thickness for all interior trim is .062 inches.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Openings shall be verified by Contractor and/or General Contractor to be within allowable tolerances, plumb, level, clean, providing a solid anchoring surface, and in accordance with approved shop drawings. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation. Unsatisfactory conditions shall be corrected prior to installation.

C. For window replacement projects, existing windows shall not be removed until the new replacement windows are available and ready for immediate installation. Openings shall not be left uncovered at the end of the working day, during wind driven precipitation, or very cold weather. Existing window removal and replacement with new windows for any individual room shall be done within the same day.

D. Perform all other operations that are necessary to prepare openings for proper installation and

operation of new window sills.

E. For projects which contain hazardous window materials identified by the pre-construction test results: Contractor shall note well that this contract calls for the complete removal of all existing window sashes in a complete and intact condition. Should any existing sash fragment or break prior to disposal, the Contractor shall immediately stop all work and contact the Owner's on-call Project Manager for review and direction.

3.02 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations, approved shop drawings, and all pertinent regulations and codes. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. All window and related window components shall be installed in accordance with the requirements of the Owner and the approved shop drawings of the manufacturer. All installations shall be by the window manufacturer, or their approved representative, using mechanics skilled and experienced in the erection of aluminum window units.

C. Set units plumb, level, and true to line, (relative to building structure) without warp or rack of frames, sash, or panels or impeding thermal movement. Anchor securely in place to structural support to prevent distortion or misalignment. The maximum variation from plumb and level shall not exceed 1/8" (plus or minus) in ten (10) feet.

D. Fiberglass insulation shall be compressed between new window frame and existing construction or between frame and new blocking as applicable. Approved insulation materials (R-19 or better) shall be installed in the frame cavity on the interior portion of the window frame. Area adjacent to the exterior of the window frame shall remain un-insulated. The window installer shall use caution in the insulation operation to avoid overlapping insulation materials across the thermal break connector, thus bridging the two separated frame members.

E. Aluminum shall be insulated from direct contact with steel, masonry, concrete, or non-compatible materials by bituminous paint, zinc chromate primer, or other suitable insulating material.

F. Exterior joints between windows and surrounding construction shall be sealed per specifications and approved shop drawings.

G. Joint Sealant Application:

1. Joints and surfaces to receive sealants shall be dry, clean, and free from loose material, efflorescence, or mortar leaching. Sealants shall not be applied when temperature is below sealant manufacturer's recommendations.

2. A Grade "A" type caulking compound from *Pecora, Tremco, Vulkem* or equal, as approved by the Architect, shall be applied per the installation drawings and details at all points where the aluminum master frame and/or panning intersects the masonry or other exterior wall finish. The caulking material shall be applied in a manner which insures a continuous air and water tight perimeter seal. Color to match the color of the aluminum windows, unless specified otherwise by the Architect.

3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

H. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

I. Exposed Fastener Concealment: Note: No exposed fasteners shall be allowed at any aluminum assemblies. The Contractor shall supply and install all concealment panning as required to fully enclose any exposed fasteners which may be a result of the system installations. The panning enclosures shall be of identical material in both composition and appearance, as the aluminum systems specified herein, in order to provide a seamless, and professional installation.

3.03 DISPOSAL AND CARTING

A. Existing windows and all other materials removed as a part of the requirements of this Contract shall be removed from the site and become the property of the Contractor upon their removals. The Contractor shall promptly remove and legally dispose of said materials at no additional cost to the Owner.

B. Comply with all applicable laws, rules and regulations as they pertain to the legal disposal of waste materials of the type produced by the work of this Section.

3.04 FACTORY TESTING

A. One window for each seventy-five manufactured shall be randomly selected by the Owner and Architect to be tested at the manufacturer's facility for air and water infiltration in order to confirm compliance of the project's windows with the performance requirements contained in these specifications. Bidders are to include the cost of transportation, food, and lodging for four representatives of the Owner and/or Architect to witness these tests.

3.05 FIELD QUALITY CONTROL

A. Air infiltration tests conducted per ASTM E 783-81, and water resistance test conducted per AAMA 501.3, shall be performed to AAMA standards. Field test shall be performed by an AAMA-accredited, certified architectural testing laboratory in accordance with AAMA 502-90 standards, and conducted with the window manufacturer representative present. The Architect shall randomly select one pair of adjacent windows to be tested. The cost for only the initial test to be borne by the Owner; any additional testing required or corrective measures for non-conforming work shall be the responsibility of the window Contractor.

B. If a test specimen should fail any aspect of the field test, the test specimen shall be repaired or replaced and re-tested. At the Architect's discretion, up to three (3) additional windows may be tested. Subsequent to testing, all window units shall be repaired or replaced in the same manner as the test specimen(s) to assure compliance with project performance specifications.

C. The cost of re-testing and all subsequent repairs shall be borne by the window manufacturer and the window Contractor.

3.06 ADJUSTING, CLEANING AND PROTECTION

A. After installation, the erector shall remove all sealants, caulking and other misplaced materials from all surfaces, including adjacent work. The window frame and glass shall be cleaned thoroughly with materials and methods recommended by the window and glass manufacturers, and shall not cause any defacement of the work. All hardware and moving parts shall be completely lubricated.

B. Frames and balances shall be adjusted, if necessary, after installation to insure smooth and weather-tight operation.

C. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

D. Manufacturer shall clean all glass and aluminum prior to shipment.

E. Lubricate hardware and moving parts.

F. Clean aluminum surfaces and remove excess sealant.

G. Remove all debris caused by the work of this section.

H. Upon completion of cleaning efforts, leave windows in closed position.

I. Protection of newly installed windows and/or final cleaning of glass and aluminum to remove any accumulations that may have occurred during the construction period is to be the responsibility of the General Contractor or Owner.

J. Comply with manufacturer’s written recommendations for final cleaning and maintenance.

3.07 MAINTENANCE AND OPERATION INSTRUCTIONS

A. The Contractor shall instruct the Owner's maintenance staff on the care, maintenance, and operation of the installed window system including, but not limited to: cleaning and replacement of glazing, periodic lubrication of hardware, and balance adjustment.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 085659 – ALUMINUM VOICE AROUND TRANSACTION SECURITY WINDOW

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related work specified elsewhere:

1. Section 083453 – Aluminum Security Entrances and Storefronts

1.02 REFERENCE

A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment

B. ASTM E119-98 - Standard Test Methods for Fire Tests of Building Construction and Materials

C. NIJ Standard 0108.01 - (National Institute of Justice) Standard for Ballistic Resistant Protective Materials

D. ASTM B 209/B 209M - Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

E. ASTM A 666-Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.

1.03 SUBMITTALS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Submit for approval prior to fabrication the following:

1. Samples, product data (including preparation, storage and installation methods), cuts & anchor spacing, reinforcement & location, product specifications, shop drawings, test reports (current UL Listing Verification & UL 752 Test Results as provided by Underwriters Laboratories), and printed data in sufficient detail to indicate compliance with the contract documents.

2. Manufacturer’s Instructions for installation and cleaning of TSS Bullet Transaction Window Assemblies. All required submittals shall be approved prior to installation.

1.04 DESIGN PERFORMANCE

A. Through the design, manufacturing techniques and material application the TSS Aluminum Voice Around Transaction Window shall be of the “non-ricochet” type. This design is intended to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration. This design shall employ a spacer within the frame to allow for natural sound transmission. Each transaction position shall have a stainless steel dip tray as shown on the drawings. Components must be manufactured in strict accordance with the specifications, design and details. All vision panels shall be cut to size with all exposed edges polished. Necessary holes shall be pre drilled and tapped where required. Stainless Steel assembly screws and acrylic spacers shall be provided. Frame and channel shall be provided. Anchor screws shall be provided

by the installer

B. No field alterations to the construction of the units fabricated under the acceptable standards shall be allowed unless approved by the manufacturer and the architect. Standard manufacturing tolerances shall be +/- 1/16".

C. Materials shall meet or exceed UL 752 requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer shall be a Company that specializes in manufacturing products of the specified type with a minimum of five years' experience. Installer shall be a Company that specializes in product type specified and Certified for the installation by the manufacturer. Manufacturer shall provide a Mock-up, if required, for evaluation of surface preparation and application workmanship and color/finish to the Architect for approval prior to start of work.

1.05 DELIVERY, STORAGE & HANDLING

A. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations set by manufacturer. Do not install products that are under conditions outside these limits.

1.06 WARRANTY

A. All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site. Certificates of manufacturer's standard limited warranty shall be provided at project completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall be manufactured by: Total Security Solutions, Inc, 170 National Park Drive, Fowlerville, MI 48836, 800-513-1468. Attn: Sales Department, info@tssbulletproof.com. Web: www.tssbulletproof.com, or architect approved equal.

2.02 BULLET RESISTANT ALUMINUM VOICE AROUND TRANSACTION WINDOW

A. Product shall be: TSS AVA Aluminum Voice Around Transaction Window. The window system consists of custom prefabricated bullet resistant glazing section with secure air passage through frames for natural voice transmission. Available in a clear or bronze aluminum finish, incorporates either a plastic laminate or stainless steel counter. All accessories for installation are included.

B. Glazing Panels shall be Bullet Resistant Level 3, 1 1/4" LP 1250 Laminated as shown on the drawings.

C. Aluminum sections to be manufactured in accordance with ASTM B209, Extruded aluminum alloy 6063 T5 Anodized or powder coated finish to match the existing décor and be free of sharp edges or burrs when in place. Glazing Channel: U-Channel specifically designed for securing transparencies tightly in place. Angles and stops are only acceptable for top attachment.

1. Frame to be anodized aluminum 18 ga. stainless steel. The bottom of the glazing to be capped with corresponding material on the frame (ie: stainless steel on stainless steel). Provide a shelf 2" thick with a recessed deal tray. The shelf to be full width of window, 12" deep, centered

under the glazing and covered with a stainless steel 18 ga. #4 finish).

2. Deal tray to be 18 ga. stainless steel, # 4 finish 16" x 10" from the outside edge of flanges with a clear opening with a stainless steel counter.

3. Provide a shelf 1 1/2" thick with a recessed cash tray. The shelf to be full width of window, 18" deep, centered under the glazing and covered with a black high pressure laminate. (Optional stainless steel 18 ga. #4 finish).

D. Product shall be: TSS AVA Aluminum Voice Around Transaction Window.

1. Size shall be as indicated on the drawings.

2. Color shall be clear or as indicated on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installing the bullet resistive material, the contractor shall verify that all supports have been installed as required by the contract documents, architectural drawings, and approved shop/CAD drawings, if required. Installer shall notify architect of any unsatisfactory preparation that is responsibility of another installer.

B. Clean and prepare all surfaces per manufacturer's recommendations for achieving the best results for the substrate under the project conditions.

3.02 INSTALLATION

A. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings. Install in accordance with manufacturer's instructions and UL 752. Set all equipment plumb. All products shall be installed per installation instructions provided by Total Security Solutions, if warranty is to be issued.

B. TSS Aluminum Voice Around Transaction Window shall arrive on site as a completed unit. Unit shall be installed in provided opening (wall/door), secured to structure (anchors by others).

3.03 POST APPLICATION

A. TSS Aluminum Voice Around Transaction Window shall be installed in accordance with manufacturer's printed recommendations, including adhering to anchoring and finishing details.

B. Inspection and Cleaning: Verify installation is complete and complies with manufacturer's requirements. Clean product and accessories, removing excess sealant, labels and protective covers.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. Product Warranty: Applicable warranty shall be issued to owner upon final release of completed project.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 086300 – METAL FRAMED SKYLIGHTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:

1. Metal Framed Structural Skylights

B. Related Documents:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

C. Related Sections: The following sections contain requirements that relate to this section:

1. Section 051200 – Structural Steel Framing
2. Section 061000 – Rough Carpentry
3. Section 075216 – SBS Modified Bitumen Roofing
4. Section 075323 – EPDM Roofing System Fully Adhered
5. Section 075423 – TPO Roofing System Fully Adhered
6. Section 076000 – Flashing and Sheet Metal
7. Section 079200 – Joint Sealants
8. Section 088000 – Glazing

D. Refer to roofing system sections for roofing accessories to be built into the roofing system to accommodate work of this section.

1.02 PERFORMANCE REQUIREMENTS

A. General: Provide metal-framed skylights capable of withstanding loads and thermal and structural movements indicated without failure. Failure includes the following:

1. Deflection exceeding specified limits.
2. Thermal stresses transferred to the building structure.
3. Skylight framing members transferring stresses, including those caused by thermal and structural movement, to glazing.
4. Weakening of fasteners, attachments, and other components.

B. Deflection Limits: As follows:

1. Deflection of the entire length of framing members in direction normal to glazing plane is limited to 1/175 of clear span.

C. Lateral Support: Compression flanges 75% of flexural members requiring lateral be laterally braced by cross members with minimum depths equal to flexural member depth and by anchors to the building structure. Glazing material does not provide lateral support.

D. Structural Loads: Provide metal-framed skylights, including anchorage, capable of withstanding the effects of the following design loads when supporting full dead loads:

1. Roof Loads

a. Concentrated Load: 300 lbs applied to framing members at location that produces the most severe stress or deflection.
b. Snow Load: As noted on the Drawings.
c. Roof Loads: As noted on the Drawings.
d. Wind Loads: As noted on the Drawings.

2. Seismic Loads: As noted on the Drawings.

E. Structural Performance: Provide metal-framed skylights, including anchorage, capable of withstanding pressures indicated without material and deflection failures and permanent deformation of structural members exceeding 0.2 percent of span when tested according to ASTM E 330.

F. Air Infiltration: Provide metal-framed skylights with maximum air leakage of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of surface when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.24lb/sq. ft. (300 Pa).

G. Water Penetration: Provide metal-framed skylights that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind pressure, but not less than 15 lb/sq. ft. (718 Pa).

H. Condensation Resistance: Provide aluminum-framed systems that when tested with fixed glazing, have a frame condensation-resistance factor (CR) of not less than 46 when tested according to NFRC 500 when clear over clear insulated glass is used.

I. Thermal Movement: Provide metal-framed skylights that allow for thermal movements resulting from the following maximum change (range) in ambient temperatures by preventing buckling, sealant failure, and other detrimental effects.

1. Temperature Change (Range): 100 degrees F.

1.03 SUBMITTALS

A. General: Submit listed submittals in accordance with the Conditions of the Contract, and in conformance with Section 013300 – Submittal Procedures.

B. Product Data: Include construction details, material descriptions, dimensions and profiles of components, and finishes for metal-framed skylights.

C. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work as required.

D. Samples for Initial Selection: Manufacturer’s color charts consisting of sections of units showing the full range of colors available for factory-finished aluminum.

E. Samples for Verification: Provide color sample of selected finish on 2"x3" aluminum sheet.

F. Installer Certificates: If required, signed by manufacturer certifying that installers comply with requirements.

G. Product Test Reports: From a qualified testing agency indicating skylights comply with requirements, based on comprehensive testing of current products.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing metal-framed skylights similar to those indicated for this Project and who is acceptable to the manufacturer.

B. Professional Engineer Qualifications: A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

1.05 PROJECT CONDITIONS

A. Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating skylights without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.06 WARRANTY

A. Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures.
2. Failure of systems to meet performance requirements.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Water leakage; defined as uncontrolled water appearing on normally exposed interior surfaces of skylights from sources other than condensation, resulting from defects in skylight materials or workmanship. (Water controlled by flashing and gutters and drained back to the exterior and that cannot damage adjacent materials or finishes is not water leakage). Water leakage resulting from improper installations not part of this warranty.

B. System Warranty Period: 5 years from date of shipment from the manufacturer.

C. Finish Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work with finish defects. “Defects” is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.

1. Warranty Period for Kynar 500 Finish: 5 years from date of shipment from the manufacturer. (10 and 20 years available if specified).

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, provide Pinnacle 350/600 system by Wasco Products, Inc., Commercial Division, Wells, ME (800-388-0293), or Architect approved

equal.

B. Substitutions: Substitute manufacturers must have been in the custom skylight business for not less than a period of 15 years and must submit to the Architect the following:

1. List of similar projects successfully completed within the last five years.
2. Proof of financial capability.
3. Complete details of proposed skylight.
4. Complete specifications for Architect's review.

2.02 FRAMING MATERIALS

A. Framing Members: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 with minimum effective thickness of 0.109 inches.

B. Exterior Pressure Caps: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 with minimum effective thickness of 0.090 inches.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing; compatible with adjacent materials.

D. Exposed Flashing and Closures: Aluminum sheet alloy and temper of 1100-H14, thickness as require for proper performance.

1. Minimum Thickness: 0.032 inch Apron Flashing.
2. Minimum Thickness: 0.062 inch Closures.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories; compatible with adjacent materials.

1. Aluminum Retaining Cap Fasteners and Framing Members Fasteners: ASTM A 193/A 193M, Series 300 stainless-steel screws; type as recommended by manufacturer.
2. Connections to Supporting Structure: Series 300 Stainless Steel or ASTM A 307, hot dipped galvanized steel fasteners by installer.

F. Framing-System Sealants: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.

1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
2. Sealant conforms to USDA approval standards.

G. Bituminous Paint: Cold-applied asphalt mastic paint complying with SSPC-Paint 12, except containing no asbestos, and formulated for 30-mil thickness per coat.

2.03 GLAZING MATERIALS

A. Sloped Glass: Refer to specification Section 088000 – Glazing.

1. Glass must meet the requirements of the AAMA Glass Design for Sloped Glazing for the project.

B. Glazing Gaskets: Manufacturer's proprietary pressure-glazing gaskets of elastomer type and hardness selected by the skylight manufacturer to comply with requirements. Glazing gaskets to be extruded thermoplastic elastomer by the skylight manufacturer.

C. Spacers, Edge Blocks, and Setting Blocks: Manufacturer's standard permanent non-migrating type of elastomer type and hardness selected to comply with requirements. Spacers, Edge Blocks, and Setting Blocks to be extruded thermoplastic elastomer by the skylight manufacturer.

D. Glazing Weatherseal Sealant: Neutral-curing silicone sealant recommended by skylight and sealant manufacturers for this use and furnished by skylight manufacturer.

1. Sealant is capable of withstanding 50 percent movement in both extension and compression (total of 100 percent movement) when tested for adhesion and cohesion under maximum cyclic movement according to ASTM C 719.
2. Sealant complies with ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to substrates including other sealants with which it comes in contact, O.
3. Color: Black.

E. Flashing Sealant: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.

1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
2. Sealant conforms to USDA approval standards.

2.04 FABRICATION

A. Framing Components: As follows:

1. Factory fit and assemble components, where practical.
2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
3. Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
4. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
5. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
6. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
7. Fit and assemble components to greatest extent practicable before finishing.
8. Reinforce members as required to retain fastener threads.
9. Attach retainer bars with gasketed stainless steel fasteners spaced at a maximum of 12 inches on center.
10. Weld components before finishing and in concealed locations to greatest extent practicable to minimize distortion.
11. Before shipping, shop assemble, mark, and disassemble components that cannot be permanently shop assembled.

B. Provide continuous aluminum frame with weatherproof splice joints and locked and sealed or fully welded corners. Locate weep holes in the frame at each rafter connection to drain condensation.

C. Prepare framing to receive anchor and connection devices and fasteners.

D. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners.

2.05 ALUMINUM FINISHES

A. General: Comply with NAAMM “Metal Finishes Manual” recommendations for application and designations of finishes.

B. Finish designations prefixed by AA conform to the system for designations of aluminum finishes established by the Aluminum Association.

1. Kynar Fluoropolymer Two-Coat System: (70% PVDF) complying with AAMA 2605. Color: As Selected by Architect (3coat and 4 coat available).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Metal Protection: As follows:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

3.03 INSTALLATION

A. General: Comply with manufacturer’s written instructions for protecting, handling, and installing skylight components.

1. Fit frame joints to produce hairline joints free of burrs and distortion.
2. Rigidly secure non-movement joints.
3. Accommodate thermal and mechanical movements.
4. Install framing components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
5. Coordinate installation of flashings at skylight perimeters to maintain continuity of water barriers.
6. Set continuous curbs and flashings in a full sealant bed, unless otherwise indicated. Comply with requirements in Section 079200 – Joint Sealants.

B. Erection Tolerances: Install skylight components true in plane, accurately aligned, and without warp or rack. Adjust framing to comply with the following tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.
2. Alignment: Where surfaces abut in line and at corners and where surfaces are separated by less than 3 inches, limit offset from true alignment to less than 1/32 inch; otherwise, limit offset from true alignment to 1/8 inch.

C. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners.

D. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

3.04 CLEANING

A. Clean skylights inside and outside, immediately after installation and after sealants have cured, according to manufacturer's written recommendations.

1. Remove temporary protective coverings and strippable coatings from pre-finished metal surfaces. Remove labels and markings from all components.

B. Remove excess sealant according to sealant manufacturer's written recommendations.

3.05 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 079200 – Joint Sealants for sealant requirements applicable to threshold installation specified in this section.
4. Section 081113 – Hollow Metal Doors and Frames
5. Section 081416 – Flush Wood Doors
6. Section 081433 – Stile and Rail Doors
7. Section 084113 – Aluminum Entrances and Storefronts
8. Section 084114 – Aluminum Security Framed Entrances and Storefronts
9. Section 084123 – Fire Rated Aluminum Framed Entrances and Storefronts
10. Section 087113 – Automatic Door Operator
11. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
12. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
13. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 SUMMARY

A. UL, LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule

2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

D. General:

1. Submit in accordance with Conditions of Contract and Section 013300 – Submittal Procedures.
2. Prior to forwarding submittal:

a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

E. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

F. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

G. Closeout Submittals:

3. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule

e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

H. Inspection and Testing:

4. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

a. fire door assemblies, in compliance with NFPA 80.
b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

    a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

    a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
        1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        2) Preliminary key system schematic diagram.
        3) Requirements for key control system.
        4) Requirements for access control.
        5) Address for delivery of keys.

2. Pre-installation Conference

    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

a. Mechanical Warranty
   1) Locks
      a) Mortise: 3 years
      b) Cylindrical: 10 years
      c) Falcon: 10 years
   2) Exit Devices
      a) 3 years
   3) Closers
      a) 25 years
   4) Automatic Operators
      a) 2 years

b. Electrical Warranty
   1) Locks
      a) 1 year
   2) Exit Devices
      a) 1 year
   3) Closers
      a) 2 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of alternate manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category are only to be considered by official substitution request in accordance with the Instructions to Bidders.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Ives 5BB series

2. Acceptable Manufacturers and Products:

    a. Hager BB1191/1279 series
    b. McKinney TB series
    c. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

    a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

    a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

    a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate

electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Select
   b. Roton
   c. ABH

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:

   a. ABH PT1000
   b. Securitron CEPT-10
   c. Security Door Controls PTM

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLOOR CLOSERS

A. Manufacturers:

3. Scheduled Manufacturer:

    a. Dormakaba

4. Acceptable Manufacturers:

    b. Jackson
    c. Rixson

B. Requirements:

1. Provide floor closers complete with ball-bearing top pivot, floor plates, intermediate pivots and cement boxes unless indicated otherwise.
2. Provide one intermediate pivot for single-acting doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide floor closers with adjustable swing speed, latch speed, back-check, and built in positive stop at specified degree of opening.
4. Spring Power: Continuously adjustable over full range of closer sizes, with reduced opening force for physically handicapped.
5. Hydraulic Regulation: By tamper-proof, non-critical valves. Provide separate adjustment for latch speed, general speed, and backcheck.
6. Provide appropriate model where floor closers are specified at fire rated openings.
7. Provide lead-lined model where floor closers are specified at lead-lined doors.
8. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
9. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.07 PIVOT SETS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Dormakaba
    b. Rixson
    c. ABH

B. Requirements:

1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide appropriate model where pivot sets are scheduled at fire rated openings.
4. Provide lead-lined model where pivot sets are specified at lead-lined doors.

5. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
6. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.08 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. DCI
c. Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.09 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. DCI
c. Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.10 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage L9000 series

2. Acceptable Manufacturers and Products:

    a. Accurate 9000/9100 series
    b. Sargent 8200 series
    c. Best 45H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified locksets that comply with the following requirements:

    a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
    b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
    c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
    d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
    e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
    b. Lever Design: Schlage see hardware groups.

2.11 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage ND series

2. Acceptable Manufacturers and Products:

a. Sargent 11-Line
b. Corbin-Russwin CL3100 series
c. Best 9K series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
b. Lever Design: Schlage Rhodes.

2.12 DEADLOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage L400 series

2. Acceptable Manufacturers and Products:

a. Best 38H series
b. Sargent 4870 series

B. Requirements:

1. Provide mortise deadlock series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide deadlocks with standard 2-3/4 inches (70 mm) backset. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
4. Provide manufacturer’s standard strike.

2.13 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

a. Precision APEX 2000 series
b. Sargent 19-43-GL-80 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer’s approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
17. Special Options:

    a. **SI**: Provide dogging indicators for visible indication of dogging status.
    b. **QM**: Rim Exit Devices: provide devices with damper-controlled re-latching to reduce operational noise. Where lever trim is specified, provide damper controlled lever return.
    c. **CVC**: Concealed Vertical Cable Exit Devices: provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
        1) Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
        2) Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
        3) Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper-infiltrated steel, with molybdenum disulfide low friction coating.
        4) Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than $90^{\text{-degree}}$ engagement with strike to prevent door and frame separation under high static load.
        5) Bottom Latchbolt: Minimum of 0.44-inch (11 mm) engagement with strike.
        6) Product Cycle Life: 1,000,000 cycles.
        7) Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
        8) Latch release does not require separate trigger mechanism.
        9) Cable and latching system characteristics:
            a) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.

b) Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
c) Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
d) Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
e) Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.

2.14 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Von Duprin 6000 Series.

2. Acceptable Manufacturers and Products:

   a. Folger Adam 300 Series
   b. HES 1006 Series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.15 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Schlage/Von Duprin PS900 Series

2. Acceptable Manufacturers and Products:

   a. Precision ELR series
   b. Sargent 3500 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:

   a. 12/24 VDC Output, field selectable.

b. Class 2 Rated power limited output.
c. Universal 120-240 VAC input.
d. Low voltage DC, regulated and filtered.
e. Polarized connector for distribution boards.
f. Fused primary input.
g. AC input and DC output monitoring circuit w/LED indicators.
h. Cover mounted AC Input indication.
i. Tested and certified to meet UL294.
j. NEMA 1 enclosure.
k. Hinged cover w/lock down screws.
l. High voltage protective cover.

2.16 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

a. Match Existing

2. Acceptable Manufacturers and Products:

a. No Substitute

B. Requirements:

1. Provide permanent or interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.17 KEYING

A. Scheduled System:

1. Existing factory registered system:

a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

OR

B. Requirements:

1. Construction Keying:

a. Replaceable Construction Cores. (OPTION: if using temporary construction cores in IC core cylinder in either F/S or S/F.)
1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
a) 3 construction control keys
b) 12 construction change (day) keys.
2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:

    a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
        1) Master Keying system as directed by the Owner.
    b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
    c. Provide keys with the following features:
        1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
        2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
        3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

    d. Identification:
        1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
        2) Identification stamping provisions must be approved by the Architect and Owner.
        3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
        4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
        5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

    e. Quantity: Furnish in the following quantities.
        1) Change (Day) Keys: 3 per cylinder/core.
        2) (OPTION for interchangeable cores) Permanent Control Keys: 3.
        3) Master Keys: 6.

2.18 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Telkee

2. Acceptable Manufacturers:

    a. HPC
    b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.19 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4010/4110/4020 series

2. Acceptable Manufacturers and Products:

b. Corbin-Russwin DC8000 series
c. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.20 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4050A series

2. Acceptable Manufacturers and Products:

a. Norton 7500 series
b. Sargent 351 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.21 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. LCN 4600 series

2. Acceptable Manufacturers and Products:

   a. Norton 6000 series
   b. Besam Power Swing

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide wireless actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED’s, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to “KEYING” article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.22 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives.

2. Acceptable Manufacturers:

a. Trimco
b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.23 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.24 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Rixson
b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.25 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Trimco
   b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.26 THRESHOLDS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Pemko

2. Acceptable Manufacturers:

   a. No Substitute

B. Requirements:

3. Provide thresholds as specified and per architectural details. Match finish of other items.
4. For Level floor use 2548A
5. For 3/8” offset use 200A x 228 A
6. For 1/2” offset use R.50.SMRAK
7. For 3/4" offset use R.75.SMRAK
8. Over 3/4" offset use R.VARI/AK

2.27 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Rockwood
   b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.28 ROLLER LATCHES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. Trimco

B. Requirements:

1. Provide roller latches with 4-7/8 inches (124 mm) strike at single doors to fit ANSI frame prep. If dummy levers are used in conjunction with roller latch mount roller latch at a height as to not interfere with proper mounting and height of dummy lever.
2. Provide roller latches with 2-1/4 inches (57 mm) full lip strike at pair doors. Mount roller in top rail of each leaf per manufacturer's template.

2.29 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. LCN

2. Acceptable Manufacturers:

a. Rixson
b. Sargent

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.20 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)

8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Construction Cores Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

D. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by a representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore to proper function of doors and hardware. Consult with and instruct the Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials, or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

106583 OPT0359740 Version 2

HARDWARE SET NO. 01 - SINGLE PASSAGE
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PASSAGE SET	ND10D RHO 14-047		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 02 - SINGLE PASSAGE - A/G DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PASSAGE SET	ND10D RHO 14-047		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 02A - SINGLE PASSAGE - A/G DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PASSAGE SET	ND10D RHO 14-047		626	SCH
1	EA	OH STOP	90S		630	GLY
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 03 - SINGLE RESTROOM
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	OH STOP	90S		630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 03A - SINGLE RESTROOM
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 03B - SINGLE RESTROOM - EXISTING FRAME
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 04 - SINGLE OFFICE
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BDC RHO		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 04A - SINGLE OFFICE - A/G DOOR

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BDC RHO 14-047		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 05 - SINGLE CLASSROOM SECURITY

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 05A - SINGLE CLASSROOM SECURITY

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 05B - SINGLE CLASSROOM SECURITY

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 05C - SINGLE CLASSROOM SECURITY - EXISTING FRAME

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:

NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 05D - SINGLE CLASSROOM SECURITY - EXISTING FRAME

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:

NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 05E - SINGLE CLASSROOM SECURITY - MAG HOLD OPEN
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	FIRE/LIFE HOLDER	4040SEH 24V/120V AC/DC AS REQ		689	LCN
1	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

NOTE: 4040SEH HOLDER AND STOP ARM CLOSER MUST BE TEMPLATED TO SAME DEGREE OF OPENING OTHERWISE DAMAGE MAY OCCUR TO HOLDER IF FORCED BEYOND ITS LIMIT.

HARDWARE SET NO. 05F - SINGLE CLASSROOM SECURITY - EXISTING FRAME
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 06 - SINGLE CLASSROOM SECURITY - A/G DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO 14-047 IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 06A - SINGLE CLASSROOM SECURITY - A/G DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO 14-047 IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4021T		689	LCN
1	EA	MOUNTING PLATE	4020T-18 SRT		689	LCN
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 07 - PAIR CLASSROOM SECURITY
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	AUTO FLUSH BOLT	FB41P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		BLK	IVE
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 08 - SINGLE STOREROOM
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 08A - SINGLE STOREROOM

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 08B - SINGLE STOREROOM

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 08C - SINGLE STOREROOM

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 08D - SINGLE STOREROOM

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 08E - SINGLE STOREROOM - EXISTING FRAME
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 08G - SINGLE STOREROOM - EXISTING FRAME
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 09 - PAIR STOREROOM
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
2	EA	MANUAL FLUSH BOLT	FB358		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
2	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 09A - PAIR STOREROOM - EXISTING FRAME
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	AUTO FLUSH BOLT	FB41P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		BLK	IVE
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 09B - PAIR STOREROOM - EXISTING FRAME
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	CONST LATCHING BOLT	FB61P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	SURFACE CLOSER	4011		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 10 - VAULT DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	ELEC CLASSROOM LOCK	CO-200-CY-70-KP-RHO-B 4B BATTERY OPERATED		626	SCE
1	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 11 - SINGLE EXIT - EXISTING FRAME
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-06		626	VON
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 12A - SINGLE EXIT - LOCKDOWN
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-2SI-06		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 13 - PAIR EXITS
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-BE-F-LBRAFL-06-499F		626	VON
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 14 - PAIR EXITS - MAG HOLD OPEN
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-F-LBRAFL-06-499F		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	MAGNET	SEM7830 12V/24V/120V PROVIDE EXTENSIONS AS REQUIRED		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 14A - PAIR EXITS - MAG HOLD OPEN
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-F-LBRAFL-06-499F		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	FIRE/LIFE HOLDER	4040SEH 24V/120V AC/DC AS REQ		689	LCN
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

NOTE: 4040SEH HOLDER AND STOP ARM CLOSER MUST BE TEMPLATED TO SAME DEGREE OF OPENING OTHERWISE DAMAGE MAY OCCUR TO HOLDER IF FORCED BEYOND ITS LIMIT.

HARDWARE SET NO. 15 - PAIR EXITS - LOCKDOWN
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	LD-9827-EO-LBR		630	VON
1	EA	PANIC HARDWARE	LD-9827-L-2SI-LBR-06		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 15A - PAIR EXITS - LOCKDOWN
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR-499F		630	VON
1	EA	FIRE EXIT HARDWARE	9827-L-F-2SI-LBRAFL-06-499F		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 15B - PAIR EXITS - LOCKDOWN - EXISTING FRAME
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR-499F		630	VON
1	EA	FIRE EXIT HARDWARE	9827-L-F-2SI-LBRAFL-06-499F		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

EXISTING FRAME:
NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

HARDWARE SET NO. 16 - PAIR EXITS - LOCKDOWN - MAG HOLD OPEN
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	PANIC HARDWARE	LD-9827-EO-LBR		630	VON
1	EA	PANIC HARDWARE	LD-9827-L-2SI-LBR-06		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	MAGNET	SEM7830 12V/24V/120V PROVIDE EXTENSIONS AS REQUIRED		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 17 - PAIR EXITS - A/G DOORS - MAG HOLD OPEN
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	LD-9827-EO-LBR		630	VON
1	EA	PANIC HARDWARE	LD-9827-L-2SI-LBR-06		626	VON
2	EA	RIM CYLINDER	1E72		626	BES
2	EA	FIRE/LIFE HOLDER	4040SEH 24V/120V AC/DC AS REQ		689	LCN
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

NOTE: 4040SEH HOLDER AND STOP ARM CLOSER MUST BE TEMPLATED TO SAME DEGREE OF OPENING OTHERWISE DAMAGE MAY OCCUR TO HOLDER IF FORCED BEYOND ITS LIMIT.

HARDWARE SET NO. 18 - SINGLE FRP EXTERIOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	CD-98-NL-OP-110MD		630	VON
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	FLUSH PULL	BY DOOR MANUFACTURER			
1	EA	SURFACE CLOSER	4111 HCUSH		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM

NOTE: THRESHOLD:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228 A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK OVER 3/4" OFFSET USE: R.VARI/AK

HARDWARE SET NO. 19 - PAIR EXTERIOR ALUMINUM AND GLASS
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-35A-EO		626	VON
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
3	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	ELECTRIC STRIKE	RE-USE EXISTING			
2	EA	90 DEG OFFSET PULL	8190EZHD 10" STD		630-316	IVE
2	EA	OH STOP & HOLDER	90H		630	GLY
2	EA	SURFACE CLOSER	4021		689	LCN
2	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM
2	EA	DOOR POSITION SWITCH	RE-USE EXISTING			

NOTE: THRESHOLD:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228 A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK OVER 3/4" OFFSET USE: R.VARI/AK

HARDWARE SET NO. 20 - PAIR EXTERIOR FRP
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-98-EO		630	VON
1	EA	PANIC HARDWARE	CD-98-NL-OP-110MD		630	VON
1	EA	RIM CYLINDER	1E72		626	BES
3	EA	MORTISE CYLINDER	1E74		626	BES
2	EA	FLUSH PULL	BY DOOR MANUFACTURER			
2	EA	SURFACE CLOSER	4111 HCUSH		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM

NOTE: THRESHOLD:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228 A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK OVER 3/4" OFFSET USE: R.VARI/AK

END OF SECTION

Door Numbers	HwSet#
100A	14A
100B	14A
100C	14A
102	05A
103	08
104	08
105	08
106	06A
107	06A
108	05
109	02
110	02
111	06
112	06
113	06
114	04A
115	04A
116	06
117	02A
118	02A
119	20
120	02
121	02
122	06
123	01
124	20
125	04
126	10
128	04
129	04
130	04
131	04
132	04
133	04
134	04
135	04
136	04
137	04
138	08B
139	08
140	06
141	06A
142	15
143	15
144	17
145	08C

Door Numbers	HwSet#
145A	05A
146	08C
147	05A
148	05E
149	05E
150	17
151	17
152	05E
153	05E
154	05A
155	06
156	06A
157	14
158	16
159	13
160	20
161	19
162	08D
163	05
164	05B
165	08A
166	04
167	05
168	07
168A	09
170	05C
171	08E
172	03B
173	03B
174	05C
175	08G
200	20
201	15A
202	12A
203	05B
204	03
205	05A
206	05
207	18
208	08
209	12A
210	05B
211	03
212	08
213	05B
214	05

Door Numbers	HwSet#
215	18
216	11
217	08D
218	08E
219	08E
220	08E
221	05D
222	05B
223	05B
224	05F
225	03B
226	05D
227	05
228	05
229	05A
230	08E
231	08E
232	08G
233	11
234	03A
235	09B
236	03A
237	05
238	08C
239	08C
240	19
241	15B
242	15B
243	15B
244	09A
245	09A
246	09A
247	09A

DIVISION 08 – OPENINGS

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 079200 – Joint Sealants for sealant requirements applicable to threshold installation specified in this section.
4. Section 081113 – Hollow Metal Doors and Frames
5. Section 081416 – Flush Wood Doors
6. Section 081433 – Stile and Rail Doors
7. Section 084113 – Aluminum Entrances and Storefronts
8. Section 084114 – Aluminum Security Framed Entrances and Storefronts
9. Section 084123 – Fire Rated Aluminum Framed Entrances and Storefronts
10. Section 087113 – Automatic Door Operator
11. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
12. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
13. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 SUMMARY

A. UL, LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule

2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

D. General:

1. Submit in accordance with Conditions of Contract and Section 013300 – Submittal Procedures.
2. Prior to forwarding submittal:

a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

E. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

F. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

G. Closeout Submittals:

3. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule

e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

H. Inspection and Testing:

4. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

a. fire door assemblies, in compliance with NFPA 80.
b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

    a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

    a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
        1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        2) Preliminary key system schematic diagram.
        3) Requirements for key control system.
        4) Requirements for access control.
        5) Address for delivery of keys.

2. Pre-installation Conference

    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

a. Mechanical Warranty
   1) Locks
      a) Mortise: 3 years
      b) Cylindrical: 10 years
      c) Falcon: 10 years
   2) Exit Devices
      a) 3 years
   3) Closers
      a) 25 years
   4) Automatic Operators
      a) 2 years

b. Electrical Warranty
   1) Locks
      a) 1 year
   2) Exit Devices
      a) 1 year
   3) Closers
      a) 2 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of alternate manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category are only to be considered by official substitution request in accordance with the Instructions to Bidders.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Ives 5BB series

2. Acceptable Manufacturers and Products:

    a. Hager BB1191/1279 series
    b. McKinney TB series
    c. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

    a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

    a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

    a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate

electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Select
   b. Roton
   c. ABH

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:

   a. ABH PT1000
   b. Securitron CEPT-10
   c. Security Door Controls PTM

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLOOR CLOSERS

A. Manufacturers:

3. Scheduled Manufacturer:

    a. Dormakaba

4. Acceptable Manufacturers:

    b. Jackson
    c. Rixson

B. Requirements:

1. Provide floor closers complete with ball-bearing top pivot, floor plates, intermediate pivots and cement boxes unless indicated otherwise.
2. Provide one intermediate pivot for single-acting doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide floor closers with adjustable swing speed, latch speed, back-check, and built in positive stop at specified degree of opening.
4. Spring Power: Continuously adjustable over full range of closer sizes, with reduced opening force for physically handicapped.
5. Hydraulic Regulation: By tamper-proof, non-critical valves. Provide separate adjustment for latch speed, general speed, and backcheck.
6. Provide appropriate model where floor closers are specified at fire rated openings.
7. Provide lead-lined model where floor closers are specified at lead-lined doors.
8. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
9. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.07 PIVOT SETS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Dormakaba
    b. Rixson
    c. ABH

B. Requirements:

1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide appropriate model where pivot sets are scheduled at fire rated openings.
4. Provide lead-lined model where pivot sets are specified at lead-lined doors.

5. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
6. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.08 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. DCI
c. Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.09 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. DCI
c. Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.10 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage L9000 series

2. Acceptable Manufacturers and Products:

    a. Accurate 9000/9100 series
    b. Sargent 8200 series
    c. Best 45H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified locksets that comply with the following requirements:

    a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
    b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
    c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
    d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
    e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
    b. Lever Design: Schlage see hardware groups.

2.11 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage ND series

2. Acceptable Manufacturers and Products:

a. Sargent 11-Line
b. Corbin-Russwin CL3100 series
c. Best 9K series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
b. Lever Design: Schlage Rhodes.

2.12 DEADLOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage L400 series

2. Acceptable Manufacturers and Products:

a. Best 38H series
b. Sargent 4870 series

B. Requirements:

1. Provide mortise deadlock series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide deadlocks with standard 2-3/4 inches (70 mm) backset. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
4. Provide manufacturer’s standard strike.

2.13 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

a. Precision APEX 2000 series
b. Sargent 19-43-GL-80 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer’s approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
17. Special Options:

    a. **SI**: Provide dogging indicators for visible indication of dogging status.
    b. **QM**: Rim Exit Devices: provide devices with damper-controlled re-latching to reduce operational noise. Where lever trim is specified, provide damper controlled lever return.
    c. **CVC**: Concealed Vertical Cable Exit Devices: provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
        1) Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
        2) Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
        3) Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper-infiltrated steel, with molybdenum disulfide low friction coating.
        4) Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than $90^{\text{-degree}}$ engagement with strike to prevent door and frame separation under high static load.
        5) Bottom Latchbolt: Minimum of 0.44-inch (11 mm) engagement with strike.
        6) Product Cycle Life: 1,000,000 cycles.
        7) Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
        8) Latch release does not require separate trigger mechanism.
        9) Cable and latching system characteristics:
            a) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.

b) Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
c) Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
d) Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
e) Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.

2.14 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Von Duprin 6000 Series.

2. Acceptable Manufacturers and Products:

   a. Folger Adam 300 Series
   b. HES 1006 Series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.15 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Schlage/Von Duprin PS900 Series

2. Acceptable Manufacturers and Products:

   a. Precision ELR series
   b. Sargent 3500 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:

   a. 12/24 VDC Output, field selectable.

b. Class 2 Rated power limited output.
c. Universal 120-240 VAC input.
d. Low voltage DC, regulated and filtered.
e. Polarized connector for distribution boards.
f. Fused primary input.
g. AC input and DC output monitoring circuit w/LED indicators.
h. Cover mounted AC Input indication.
i. Tested and certified to meet UL294.
j. NEMA 1 enclosure.
k. Hinged cover w/lock down screws.
l. High voltage protective cover.

2.16 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

a. Match Existing

2. Acceptable Manufacturers and Products:

a. No Substitute

B. Requirements:

1. Provide permanent or interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.17 KEYING

A. Scheduled System:

1. Existing factory registered system:

a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

OR

B. Requirements:

1. Construction Keying:

a. Replaceable Construction Cores. (OPTION: if using temporary construction cores in IC core cylinder in either F/S or S/F.)
1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
a) 3 construction control keys
b) 12 construction change (day) keys.
2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:

    a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
        1) Master Keying system as directed by the Owner.
    b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
    c. Provide keys with the following features:
        1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
        2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
        3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

    d. Identification:
        1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
        2) Identification stamping provisions must be approved by the Architect and Owner.
        3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
        4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
        5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

    e. Quantity: Furnish in the following quantities.
        1) Change (Day) Keys: 3 per cylinder/core.
        2) (OPTION for interchangeable cores) Permanent Control Keys: 3.
        3) Master Keys: 6.

2.18 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Telkee

2. Acceptable Manufacturers:

    a. HPC
    b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.19 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4010/4110/4020 series

2. Acceptable Manufacturers and Products:

b. Corbin-Russwin DC8000 series
c. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.20 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4050A series

2. Acceptable Manufacturers and Products:

a. Norton 7500 series
b. Sargent 351 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.21 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. LCN 4600 series

2. Acceptable Manufacturers and Products:

   a. Norton 6000 series
   b. Besam Power Swing

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide wireless actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED’s, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to “KEYING” article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.22 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives.

2. Acceptable Manufacturers:

a. Trimco
b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.23 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.24 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Rixson
b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.25 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Trimco
   b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.26 THRESHOLDS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Pemko

2. Acceptable Manufacturers:

   a. No Substitute

B. Requirements:

3. Provide thresholds as specified and per architectural details. Match finish of other items.
4. For Level floor use 2548A
5. For 3/8” offset use 200A x 228 A
6. For 1/2” offset use R.50.SMRAK
7. For 3/4" offset use R.75.SMRAK
8. Over 3/4" offset use R.VARI/AK

2.27 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Rockwood
   b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.28 ROLLER LATCHES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. Trimco

B. Requirements:

1. Provide roller latches with 4-7/8 inches (124 mm) strike at single doors to fit ANSI frame prep. If dummy levers are used in conjunction with roller latch mount roller latch at a height as to not interfere with proper mounting and height of dummy lever.
2. Provide roller latches with 2-1/4 inches (57 mm) full lip strike at pair doors. Mount roller in top rail of each leaf per manufacturer's template.

2.29 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. LCN

2. Acceptable Manufacturers:

a. Rixson
b. Sargent

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.20 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)

8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Construction Cores Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

D. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by a representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore to proper function of doors and hardware. Consult with and instruct the Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials, or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

110668 OPT0369479 Version 2

HARDWARE SET NO. 01 - SINGLE PASSAGE
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PASSAGE SET	ND10D RHO 13-247		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 01A - SINGLE PASSAGE
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PASSAGE SET	ND10S RHO 14-010		626	SCH
1	EA	OH STOP	90S		630	GLY
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	SET	GASKETING	870AA-S		AA	ZER
1	EA	DOOR BOTTOM	364AA		AA	ZER
1	EA	MOUNTING BRACKET	870SPB FOR RIM STRIKE AND/OR CLOSER			ZER

HARDWARE SET NO. 02 - SINGLE RESTROOM
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 03 - SINGLE OFFICE

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BDC RHO		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 04 - SINGLE CLASSROOM SECURITY

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 04A - SINGLE CLASSROOM SECURITY

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 04B - SINGLE CLASSROOM SECURITY - SOUND SEALS

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO 14-028 IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	SET	GASKETING	870AA-S		AA	ZER
1	EA	DOOR BOTTOM	364AA		AA	ZER
1	EA	MOUNTING BRACKET	870SPB FOR RIM STRIKE AND/OR CLOSER			ZER

HARDWARE SET NO. 04C - SINGLE CLASSROOM SECURITY
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 04D - SINGLE CLASSROOM SECURITY
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 05 - SINGLE CLASSROOM SECURITY - A/G DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO 14-047 IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4021T		689	LCN
1	EA	MOUNTING PLATE	4020T-18 SRT		689	LCN
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

HARDWARE SET NO. 06 - PAIR CLASSROOM SECURITY
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	AUTO FLUSH BOLT	FB41P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM SECURITY 0	ND78BDC RHO IS-CRS		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		BLK	IVE
2	EA	SURFACE CLOSER	4111 CUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 07 - SINGLE STOREROOM
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
2	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 08 - VAULT DOOR
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	ELEC CLASSROOM LOCK	CO-200-CY-70-KP-RHO-B 4B BATTERY OPERATED		626	SCE
1	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64 (OMIT WHERE SMOKE/FIRE SEALS ARE PROVIDED)		GRY	IVE

HARDWARE SET NO. 09 - PAIR EXITS
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-BE-F-LBRAFL-06-499F		626	VON
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
2	EA	MAGNET	SEM7830 12V/24V/120V PROVIDE EXTENSIONS AS REQUIRED		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 10 - PAIR DOUBLE EGRESS
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	FIRE EXIT HARDWARE	9827-EO-F-LBRAFL-499F		630	VON
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
4	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	MAGNET	SEM7830 12V/24V/120V PROVIDE EXTENSIONS AS REQUIRED		689	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 11 - PAIR EXTERIOR ALUMINUM AND GLASS - SECURITY
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	REMOVABLE MULLION	KR4854		689	VON
1	EA	PANIC HARDWARE	CD-35A-EO		626	VON
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
3	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE CON 12/24 VAC/VDC		630	VON
2	EA	90 DEG OFFSET PULL	8190EZHD 10" STD		630-316	IVE
2	EA	OH STOP & HOLDER	90H		630	GLY
2	EA	SURFACE CLOSER	4021		689	LCN
2	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM
2	EA	WIRE HARNESS	CON-50 FOR USE INSIDE MULLION			SCH
2	EA	WIRE HARNESS	CON-6W (WIRE LEADS FOR CONNECTION TO POWER)			SCH

NOTE: THRESHOLD:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228 A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK OVER 3/4" OFFSET USE: R.VARI/AK

HARDWARE SET NO. 11A - PAIR VESTIBULE ALUMINUM AND GLASS - SECURITY
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	REMOVABLE MULLION	KR4854		689	VON
1	EA	PANIC HARDWARE	CD-35A-EO		626	VON
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
3	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE CON 12/24 VAC/VDC		630	VON
2	EA	90 DEG OFFSET PULL	8190EZHD 10" STD		630-316	IVE
2	EA	OH STOP & HOLDER	90H		630	GLY
2	EA	SURFACE CLOSER	4021		689	LCN
2	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
2	EA	WIRE HARNESS	CON-50 FOR USE INSIDE MULLION			SCH
2	EA	WIRE HARNESS	CON-6W (WIRE LEADS FOR CONNECTION TO POWER)			SCH

HARDWARE SET NO. 12 - SINGLE EXTERIOR ALUMINUM AND GLASS - SECURITY
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE CON 12/24 VAC/VDC		630	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD		630-316	IVE
1	EA	FLUSH PULL	BY DOOR MANUFACTURER			
1	EA	OH STOP & HOLDER	90H		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM

NOTE: THRESHOLD:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228 A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK OVER 3/4" OFFSET USE: R.VARI/AK

HARDWARE SET NO. 12A - SINGLE VESTIBULE ALUMINUM AND GLASS - SECURITY
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE CON 12/24 VAC/VDC		630	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD		630-316	IVE
1	EA	FLUSH PULL	BY DOOR MANUFACTURER			
1	EA	OH STOP & HOLDER	90H		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM

HARDWARE SET NO. 13 - SINGLE EXTERIOR ALUMINUM AND GLASS
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388		626	VON
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD		630-316	IVE
1	EA	FLUSH PULL	BY DOOR MANUFACTURER			
1	EA	OH STOP & HOLDER	90H		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	FLUSH CEILNG MTG PLATE	4020-18G SRT		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			
1	EA	THRESHOLD	SEE BELOW			PEM

NOTE: THRESHOLD:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228 A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK OVER 3/4" OFFSET USE: R.VARI/AK

END OF SECTION

Door Numbers	HwSet#
101	11
102	12
103	11A
104	12A
105	05
106	04
107	13
108	09
109	04
110	04C
111	01
112	03
113	01
114	03
115	02
116	03
117	02
118	08
119	07
120	07
121	03
122	02
123	03
124	03
125	04A
126	04D
201	10
202	04B
203	04B
204	01A
301	06
302	04C
303	07
304	04C
305	06
306	06
307	10

DIVISION 08 – OPENINGS

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 079200 – Joint Sealants for sealant requirements applicable to threshold installation specified in this section.
4. Section 081113 – Hollow Metal Doors and Frames
5. Section 081416 – Flush Wood Doors
6. Section 081433 – Stile and Rail Doors
7. Section 084113 – Aluminum Entrances and Storefronts
8. Section 084114 – Aluminum Security Framed Entrances and Storefronts
9. Section 084123 – Fire Rated Aluminum Framed Entrances and Storefronts
10. Section 087113 – Automatic Door Operator
11. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
12. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
13. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 SUMMARY

A. UL, LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule

2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

D. General:

1. Submit in accordance with Conditions of Contract and Section 013300 – Submittal Procedures.
2. Prior to forwarding submittal:

a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

E. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

F. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

G. Closeout Submittals:

3. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule

e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

H. Inspection and Testing:

4. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

a. fire door assemblies, in compliance with NFPA 80.
b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

    a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

    a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
        1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        2) Preliminary key system schematic diagram.
        3) Requirements for key control system.
        4) Requirements for access control.
        5) Address for delivery of keys.

2. Pre-installation Conference

    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

a. Mechanical Warranty
   1) Locks
      a) Mortise: 3 years
      b) Cylindrical: 10 years
      c) Falcon: 10 years
   2) Exit Devices
      a) 3 years
   3) Closers
      a) 25 years
   4) Automatic Operators
      a) 2 years

b. Electrical Warranty
   1) Locks
      a) 1 year
   2) Exit Devices
      a) 1 year
   3) Closers
      a) 2 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of alternate manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category are only to be considered by official substitution request in accordance with the Instructions to Bidders.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Ives 5BB series

2. Acceptable Manufacturers and Products:

    a. Hager BB1191/1279 series
    b. McKinney TB series
    c. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

    a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

    a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

    a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate

electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Select
   b. Roton
   c. ABH

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:

   a. ABH PT1000
   b. Securitron CEPT-10
   c. Security Door Controls PTM

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLOOR CLOSERS

A. Manufacturers:

3. Scheduled Manufacturer:

    a. Dormakaba

4. Acceptable Manufacturers:

    b. Jackson
    c. Rixson

B. Requirements:

1. Provide floor closers complete with ball-bearing top pivot, floor plates, intermediate pivots and cement boxes unless indicated otherwise.
2. Provide one intermediate pivot for single-acting doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide floor closers with adjustable swing speed, latch speed, back-check, and built in positive stop at specified degree of opening.
4. Spring Power: Continuously adjustable over full range of closer sizes, with reduced opening force for physically handicapped.
5. Hydraulic Regulation: By tamper-proof, non-critical valves. Provide separate adjustment for latch speed, general speed, and backcheck.
6. Provide appropriate model where floor closers are specified at fire rated openings.
7. Provide lead-lined model where floor closers are specified at lead-lined doors.
8. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
9. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.07 PIVOT SETS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Dormakaba
    b. Rixson
    c. ABH

B. Requirements:

1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide appropriate model where pivot sets are scheduled at fire rated openings.
4. Provide lead-lined model where pivot sets are specified at lead-lined doors.

5. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
6. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.08 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. DCI
c. Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.09 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Rockwood
b. DCI
c. Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.10 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage L9000 series

2. Acceptable Manufacturers and Products:

    a. Accurate 9000/9100 series
    b. Sargent 8200 series
    c. Best 45H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified locksets that comply with the following requirements:

    a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
    b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
    c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
    d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
    e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
    b. Lever Design: Schlage see hardware groups.

2.11 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage ND series

2. Acceptable Manufacturers and Products:

a. Sargent 11-Line
b. Corbin-Russwin CL3100 series
c. Best 9K series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
b. Lever Design: Schlage Rhodes.

2.12 DEADLOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage L400 series

2. Acceptable Manufacturers and Products:

a. Best 38H series
b. Sargent 4870 series

B. Requirements:

1. Provide mortise deadlock series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide deadlocks with standard 2-3/4 inches (70 mm) backset. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
4. Provide manufacturer’s standard strike.

2.13 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

a. Precision APEX 2000 series
b. Sargent 19-43-GL-80 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer’s approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
17. Special Options:

    a. **SI**: Provide dogging indicators for visible indication of dogging status.
    b. **QM**: Rim Exit Devices: provide devices with damper-controlled re-latching to reduce operational noise. Where lever trim is specified, provide damper controlled lever return.
    c. **CVC**: Concealed Vertical Cable Exit Devices: provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
        1) Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
        2) Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
        3) Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper-infiltrated steel, with molybdenum disulfide low friction coating.
        4) Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than $90^{\text{-degree}}$ engagement with strike to prevent door and frame separation under high static load.
        5) Bottom Latchbolt: Minimum of 0.44-inch (11 mm) engagement with strike.
        6) Product Cycle Life: 1,000,000 cycles.
        7) Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
        8) Latch release does not require separate trigger mechanism.
        9) Cable and latching system characteristics:
            a) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.

b) Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
c) Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
d) Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
e) Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.

2.14 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Von Duprin 6000 Series.

2. Acceptable Manufacturers and Products:

   a. Folger Adam 300 Series
   b. HES 1006 Series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.15 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Schlage/Von Duprin PS900 Series

2. Acceptable Manufacturers and Products:

   a. Precision ELR series
   b. Sargent 3500 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:

   a. 12/24 VDC Output, field selectable.

b. Class 2 Rated power limited output.
c. Universal 120-240 VAC input.
d. Low voltage DC, regulated and filtered.
e. Polarized connector for distribution boards.
f. Fused primary input.
g. AC input and DC output monitoring circuit w/LED indicators.
h. Cover mounted AC Input indication.
i. Tested and certified to meet UL294.
j. NEMA 1 enclosure.
k. Hinged cover w/lock down screws.
l. High voltage protective cover.

2.16 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

a. Match Existing

B. Requirements:

1. Provide permanent or interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.17 KEYING

A. Scheduled System:

1. Existing factory registered system:

a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

OR

B. Requirements:

1. Construction Keying:

a. Replaceable Construction Cores. (OPTION: if using temporary construction cores in IC core cylinder in either F/S or S/F.)
   1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      a) 3 construction control keys
      b) 12 construction change (day) keys.
   2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:

a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

1) Master Keying system as directed by the Owner.

b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.

c. Provide keys with the following features:
   1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
   2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
   3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

d. Identification:
   1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
   2) Identification stamping provisions must be approved by the Architect and Owner.
   3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
   4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
   5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

e. Quantity: Furnish in the following quantities.
   1) Change (Day) Keys: 3 per cylinder/core.
   2) (OPTION for interchangeable cores) Permanent Control Keys: 3.
   3) Master Keys: 6.

2.18 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Telkee

2. Acceptable Manufacturers:

   a. HPC
   b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

   a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
   b. Provide hinged-panel type cabinet for wall mounting.

2.19 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. LCN 4010/4110/4020 series

2. Acceptable Manufacturers and Products:

    b. Corbin-Russwin DC8000 series
    c. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.20 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. LCN 4050A series

2. Acceptable Manufacturers and Products:

    a. Norton 7500 series
    b. Sargent 351 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.

4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.21 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. LCN 4600 series

2. Acceptable Manufacturers and Products:

   a. Norton 6000 series
   b. Besam Power Swing

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide wireless actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED’s, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to “KEYING” article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.22 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives.

2. Acceptable Manufacturers:

a. Trimco
b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.23 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.24 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Rixson
b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.25 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Trimco
    b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.26 THRESHOLDS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Pemko

2. Acceptable Manufacturers:

    a. No Substitute

B. Requirements:

3. Provide thresholds as specified and per architectural details. Match finish of other items.
4. For Level floor use 2548A
5. For 3/8” offset use 200A x 228 A
6. For 1/2” offset use R.50.SMRAK
7. For 3/4" offset use R.75.SMRAK
8. Over 3/4" offset use R.VARI/AK

2.27 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Rockwood
    b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.28 ROLLER LATCHES

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Rockwood
   b. Trimco

B. Requirements:

1. Provide roller latches with 4-7/8 inches (124 mm) strike at single doors to fit ANSI frame prep. If dummy levers are used in conjunction with roller latch mount roller latch at a height as to not interfere with proper mounting and height of dummy lever.
2. Provide roller latches with 2-1/4 inches (57 mm) full lip strike at pair doors. Mount roller in top rail of each leaf per manufacturer's template.

2.29 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. LCN

2. Acceptable Manufacturers:

   a. Rixson
   b. Sargent

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.20 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Construction Cores Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect’s opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
   2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

D. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by a representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore to proper function of doors and hardware. Consult with and instruct the Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials, or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

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HARDWARE SET NO. 01 - SINGLE STOREROOM
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	SFIC CORE	BEST - TO MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE SET NO. 02 - BATHROOM PRIVACY
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4111 CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	COAT AND HAT HOOK	508		626	IVE

HARDWARE SET NO. 03 - VESTIBULE DEADLOCK
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CLASSROOM DEAD LOCK W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L463T OS-LOC IS-LOC		630	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	FLUSH PULL	BY DOOR MANUFACTURER			
1	EA	OH STOP	100S		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER			

NOTE:
FOR LEVEL FLOOR USE: 2548A
FOR 3/8" OFFSET USE: 200A X 228A
FOR 1/2" OFFSET USE: R.50.SMRAK
FOR 3/4" OFFSET USE: R.75.SMRAK
OVER 3/4" OFFSET USE: R.VARI/AK

END OF SECTION

Door Numbers	HwSet#
101	03
102	02
103	02
104	01
105	01
106	01

DIVISION 08 – OPENINGS

SECTION 088000 – GLAZING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install glass and glazing work as shown on the drawings and as specified herein.

1. Glass and glazing units for the following products and applications, and glazing requirements referenced by other sections:

a. Annealed (float) glass.
b. Annealed laminated safety glass.
c. Tempered laminated safety glass.
d. Tempered (heat treated) glass.
e. Insulated glass.
f. Insulated reflective glass.
g. Insulated spandrel glass.
h. Skylight insulated glass.

B. The required applications of glass and glazing include (but are not necessarily limited to) the following:

1. Window units (fixed and operable sash).
2. Aluminum, steel, FRP, and wood doors (door lights, sidelights, and transoms).
3. Interior (borrowed light) windows.
4. Storefront and curtainwall framing systems.
5. Skylights.

C. Related Documents:

1. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

D. Related Sections include the following:

1. Section 072100 – Building Insulation
2. Section 079200 – Joint Sealants
3. Section 081166 – Hollow Metal Doors and Frames
4. Section 081416 – Flush Wood Doors
5. Section 081433 – Stile and Rail Doors
6. Section 084113 – Aluminum Entrances and Storefront
7. Section 084413 – Glazed Aluminum Curtain Walls
8. Section 085113 – Aluminum Windows
9. Section 085200 – Ultimate Double Hung Wood Windows

E. Insulated metal panels glazed into exterior aluminum window frames are specified in Section 085113 – Aluminum Windows.

1.02 REFERENCE STANDARDS

A. American National Standards Institute:

1. ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

B. ASCE 7 - "Minimum Design Loads for Buildings and Other Structures".

C. American Architectural Manufacturers Association:

1. AAMA 800 - Voluntary Specifications and Test Methods for Sealants.

D. Code of Federal Regulations:

1. 16FR 1201 – Safety Standards for Architectural Glazing Materials.

E. American Society for Testing and Materials (ASTM):

1. ASTM C 162 – Standard Terminology of Glass and Glass Products.
2. ASTM C 509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
3. ASTM C 864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
4. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants.
5. ASTM C 1036 – Standard Specification for Flat Glass.
6. ASTM C 1048 – Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
7. ASTM C 1087 – Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
8. ASTM C 1115 – Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
9. ASTM C 1172 – Standard Specification for Laminated Architectural Flat Glass.
10. ASTM C 1281 – Standard Specification for Preformed Tape Sealants for Glazing Applications.
11. ASTM C 1330 – Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
12. ASTM C 1376 – Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
13. ASTM E 774 – Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
14. ASTM E 1300 – Standard Practice for Determining Load Resistance of Glass in Buildings.
15. ASTM E 2189 – Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
16. ASTM E 2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.
17. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction & Materials.

F. Glass Association of North America (GANA):

1. Glazing Manual.
2. Laminated Glass Design Guide.
3. Engineering Standards Manual.

G. The Insulating Glass Manufacturers Alliance (IGMA):

1. IGMA TB-3001 - Sloped Glazing Guidelines.
2. IGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units.

H. Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; Building Technologies Department; Windows & Daylighting Group, windows.lbl.gov/software:

1. "LBNL Window 5.0 (or higher) - A PC Program for Analyzing Window Thermal and Optical Performance.

I. National Fenestration Rating Council (NFRC):

1. NFRC 100 - Procedure for Determining Fenestration Product Thermal Properties.
2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
3. NFRC 300 - Procedures for Determining Solar Optical Properties of Simple Fenestration Products.

J. National Fire Protection Association (NFPA):

1. NFPA 80 - Fire Doors and Windows.
2. NFPA 252 - Fire Tests of Door Assemblies.
3. NFPA 257 - Fire Test for Window and Glass Block Assemblies.

K. Safety Glazing Certifications Council (SGCC):

1. SGCC – Certified Products Directory for Safety Glazing Material Used in Buildings.

L. Associated Laboratories, Inc. (ALI):

1. ALI – Certified Products Directory – Fenestration Products.

M. Federal Specifications (FS):

1. FS TT-S-230A – Sealing Compound, Synthetic Rubber Base, Single Component, Chemically Curing for Caulking, Sealing and Glazing in Building Construction.
2. FS TT-S-002303 – Sealing Compound, Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

1.03 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data - Glazing Materials:

1. Submit manufacturer's product data, specifications, and installation instructions for each type glass, glazing material and associated/ related products. Include test data substantiating that glass complies with specified requirements. Include documentation of compatibility of sealants with glazing products, and instructions for handling, storing, installation and recommended procedures for cleaning of each type of glass and glazing material.

C. Samples: Prior to the delivery of materials, submit to the Architect samples of each of the following:

1. Submit three (3) 12" square samples of each type of glass required. Architect's review of samples will be for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

2. Submit three (3) beads, approximately ¼-inch wide by 3 inches long, of each sealant to be employed, indicating color of set or cured material.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

F. Qualification Data: For installers.

G. Product Test Reports: For each of the following types of glazing products.

1. Tinted float glass.
2. Coated float glass.
3. Insulating glass.

H. Shop Drawings: Prior to placement of glass order or glass fabrication, the Contractor shall submit pertinent shop drawings (i.e. – windows, doors, borrowed light frames, etc.) which have been:

1. Checked and approved by the General Contractor, stamped and dated.
2. Reviewed by the Architect, with stamp affixed.

I. Warranties: Special warranties specified in this Section.

1.04 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or other specified gas.

D. Sealed Insulating Glass Unit Surface Designations:

1. Surface 1: Exterior surface of outer glass lite.
2. Surface 2: Interspace surface of outer glass lite.
3. Surface 3: Interspace surface of inner glass lite.
4. Surface 4: Interior surface of inner glass lite.

E. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

F. Manufacturing defects are defined as edge separation, seal failure, delamination, core cracking, loss of visibility/clarity due dusting or misting, or UV exposure, or chemical reaction to glass cleaners.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of glass products, types as specified, with minimum documented five years experience.

1. For glass sputter-coated with solar-control low-e coatings, obtain glass products in fabricated units from a manufacturer/fabricator certified by the primary glass manufacturer.

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level-2 (Senior Glaziers) or Level-3 (Master Glaziers).

C. Single Source Responsibility: Obtain materials from one source for each type of glass and glazing.

D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, including but not limited to those below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGIA Publication for Insulating Glass: SFGIA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
2. NGA Publications: “Laminated Glazing Reference Manual”; “Glazing Manual.”
3. AAMA: “Sloped Glazing Guidelines.”
4. FGIA: “Guidelines for Sloped Glazing.”

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. Fenestration and Glazing Industry Alliance.

G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 for Category I and II glazing products and, Fenestration and Glazing Industry Alliance ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
2. Lites more than 9 sq ft (0.84 sq m) in area are required to be Category II materials.
3. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sf (0.84 sq m) in area, provide glazing products that comply with Category II materials, and for lites 9 sf (0.84 sq m) or less in area, provide glazing products that comply with Category I or II materials.

H. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

    a. Perform tests under normal environmental conditions replicating those that will exist during installation.

2. Submit not fewer than nine pieces of each type and finish of glass-framing members and each

type, class, kind, condition, and form of glass (monolithic, laminated, and insulating units) as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

I. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of authorities having jurisdiction.

1.06 REGULATORY REQUIREMENTS

A. Comply with applicable provisions of all codes and standards acceptable to local, state and federal agencies having jurisdiction.

B. Perform Work in accordance with the following Glazing Standards:

1. Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual".

2. Safety Glazing: Comply with size, glazing type, location, and testing requirements of 16 CFR 1201 for Category I and II glazing products, and requirements of authorities having jurisdiction.

3. Insulating Glass: Provide insulating glass units permanently marked either on spacers or on at least one pane with appropriate certification label of Insulating Glass Certification Council (IGCC) or Associated Laboratories, Inc. (ALI).

1.07 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Specified Design Wind Loads: Provide glazing capable of withstanding wind-load design pressures calculated according to requirements of the 2020 International Building Code or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.5, "Method 2 - Analytical Procedure," whichever are more stringent. Refer to drawings for Wind Design Data.
b. Specified Design Snow Loads: As indicated on Drawings, but not less than snow loads

applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."

c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set within 15 degrees of vertical.

1) Wind Load Duration: Short duration, as defined in ASTM E 1300 or 60 seconds or less.

d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical.

1) Wind Load Duration: Short duration, as defined in ASTM E 1300 or 60 seconds or less.
2) Snow Load Duration: Long Duration, as defined in ASTM E 1300 or 30 days.

e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

1) For monolithic-glass lites heat treated to resist wind loads.
2) For insulating glass.

f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 1/4 inch (6.0 mm) thick.

2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. per h per degree F.
b. Solar Heat Gain Coefficient: NFRC 200.
c. Solar Optical Properties: NFRC 300.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Delivery:

1. Delivered materials shall match the approved samples.

2. Each panel of glass shall be factory labeled. Deliver glass with manufacturer's labels intact.

3. Packaged materials shall be delivered in the original unopened labeled containers of the manufacturer, clearly marked with their name and brand.

C. Storage and Handling:

1. Store glass in designated areas, while awaiting installation, in a dry, well-ventilated location at a constant temperature maintained above dew point away from traffic and construction.

2. Do not remove labels until glass has been installed.

3. Keep glass free from contamination by materials capable of staining or damaging glass.

4. Glass that is cracked, broken, chipped, or otherwise damaged during transportation, storage, and erection (including natural causes, accidents, and vandalism) and unfit for use shall be removed from the job site and replaced with acceptable materials at the Contractor's expense.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Perform glazing only when ambient temperature is above 40 degrees

B. When circumstances require glazing below 45 degrees F, steps shall be taken to assure dry and frost-free surfaces, as approved by the Architect.

1.10 WARRANTY

A. Manufacturer's Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the glass fabricator in which the coated glass manufacturer agrees to replace coated glass units that deteriorates during normal use within the specified warranty period. Deterioration of the coated glass is defined as peeling and/or cracking, or discoloration that is not attributed to glass breakage, seal failure, improper installation, or cleaning and maintenance that is contrary to the manufacturer's written instructions.

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Warranty on Insulating Glass: Manufacturer's standard form in which the insulating glass unit manufacturer agrees to replace insulating-glass units that deteriorate during normal use within the specified warranty period. Deterioration of insulating glass units is defined as an obstruction of vision by dust, moisture, or a film on the interior surfaces of the glass caused by a failure of the hermetic seal that is not attributed to glass breakage, improper installation, or cleaning and maintenance that is contrary to the manufacturer's written instructions.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Warranty on Laminated Glass: Manufacturer's standard form in which the laminated glass manufacturer agrees to replace laminated glass units that deteriorate during normal use within the specified warranty period. Deterioration of laminated glass is defined as defects, such as discoloration, edge separation, or blemishes exceeding those allowed by ASTM C 1172 that are not attributed to glass breakage, improper installation, or cleaning and maintenance that is contrary to the manufacturer's written instructions.

1. Warranty Period: Five years from date of Substantial Completion.

D. Installer's Warranty: Form acceptable to Owner, signed by glass product Installer, agreeing to replace glass products that deteriorate, or that exhibit damage or deterioration of glass or glazing

products due to faulty installation, within 2 years of date of manufacture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following:

A. Glass Products:

1. Manufacturers producing glass complying with the requirements include the following:

a. Vitro Architectural Glass, Glass Technology Center, 400 Guys Run Rd., Cheswick, PA 15024, (855)-887-6457, Fax: (800) 367-2986.
Email:archservices@vitro.com, http://www.vitroglazings.com

b. Guardian Glass, Auburn Hills, MI.

c. AGC Inc., Kingsport, TN.

d. Custom Glass Co., Pittsburgh, PA.

2.02 MATERIALS

A. General:

1. All glass, whether specifically shown or specified, shall conform to manufacturer's standards as to maximum size for each type of glass.

B. Annealed Float Glass, General: ASTM C 1036, Type I, Quality-Q3, class indicated.

C. Heat-Treated Float Glass, Heat-Strengthened: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind HS, of class and condition indicated: where indicated, where needed to resist thermal stresses and where required to comply with performance requirements.

D. Heat-Treated Float Glass, Fully Tempered: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT, of class and condition indicated: where safety glass is indicated. Safety glazing must comply with ANSI Z97.1 and CPSC 16CFR-1201.

E. Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during primary glass product manufacture.

F. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process following primary glass product manufacture.

G. Coated Spandrel Float Glass: Float glass complying with ASTM C 1048, GANA 'Engineering Standards Manual' 89-1-6 Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifier and other requirements specified, with manufacturer’s standard opacifier material on coated second surface of lites.

H. Laminated Glass: ASTM C 1172, with manufacturer’s standard polyvinyl butyral or cured resin interlayer.

I. Insulating-Glass Units: Factory-assembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, with manufacturer’s standard spacer material and construction, per

ASTM E 2190.

2.03 FABRICATION OF GLAZING UNITS, GENERAL

A. Fabricate glazing units in dimensions required, with edge and face clearances, edge and surface conditions, and bite in accordance with glazing product manufacturer/fabricator's instructions and referenced glazing publications.

2.04 GLASS PRODUCTS

A. **One-quarter inch (1/4") Annealed Float Glass**:

1. General:

a. Float glass is glass which has been floated on molten tin and annealed slowly to produce a transparent flat glass which eliminates grinding or polishing.

b. ASTM C 1036, Type I, Quality-Q3, class 1.

c. CPSC 16 CFR 1201, safety regulation for architectural glazing in hazardous locations; 1/4-inch thick.

B. **One-quarter inch (1/4") Heat-Treated Safety Glass:**

1. General:

a. ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat), Class 1 (clear), Quality q3 (glazing select).

b. ANSI Z97.1 and CPSC 16CFR-1201, safety regulation for architectural glazing in hazardous locations; 1/4-inch thick.

C. **Laminated Safety Glass**:

1. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:

a. ASTM C1172, Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.

2. **One-quarter inch (1/4") Safety Laminated, Polished Plate Glass**:

a. A 0.015" thick plastic (interlayer) film sandwiched between two layers of 1/8" annealed float glass.

b. CPSC 16CFR-1201, safety regulation for architectural glazing in hazardous locations; 1/4-inch thick. Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified.

c. Interlayer: Interlayer material as indicated below, clear or in colors, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

1) Interlayer Material: Polyvinyl butyral sheets or cured resin.

3. **One-half inch (1/2") Tempered Laminated Safety Glass**:

   a. Formed of two pieces of ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I (transparent), Class 1, Quality q3 (glazing select), glass 1/4-inch thick laminated together with a clear 0.015 inch thick PVB interlayer, for a 1/2-inch total nominal thickness.

   b. CPSC 16CFR-1201, safety regulation for architectural glazing in hazardous locations.

D. **One-quarter inch (1/4") Tempered Glass**:

1. General:

   a. Float glass which has been heat treated and rapidly cooled to produce compressively stressed surface layer resulting in a strength of at least four to five times that of annealed glass and complying with strength requirements of FS-DD-G-1403B for Grade B, Tempered Glass.

   b. CPSC 16CFR-1201, safety regulation for architectural glazing in hazardous locations; when used in a dual glazed unit 1/4" thick.

2.05 INSULATING GLASS UNITS

A. **One Inch (1") Insulated Glass**:

1. General:

   a. Factory-assembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, with manufacturer's standard spacer material and construction, per ASTM E 2190.

   b. All insulating glass units, whether specifically shown or specified, shall conform to the manufacturer's standards as to maximum size for each type of glass.

   c. Fabricate glazing units in dimensions required, with edge and face clearances, edge and surface conditions, and bite in accordance with glazing product manufacturer/fabricator's instructions and referenced glazing publications.

2. **High Performance Insulating Glass**: Formed of two 1/4-inch lites of glass separated by a 1/2-inch Argon Gas filled space hermetically sealed, for a total 1 inch nominal thickness conforming to ASTM E 2190, consisting of:

   a. Outer Lite: ASTM C1036, Type I, Class 1 (tint - color as selected by architect), Quality q3.

      1) Kind FT (Full Tempered)
      2) 1/4-inch thick glass.
      3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376.
      4) Coating: "Solarban" 70 Solar Control Low-E (Sputtered) by Vitro Architectural Glass on the second surface (2).

   b. Interspace Content: Air (10%) / Argon (90%) Mix 1/2" (12.7mm).

   c. Inside Lite: ASTM C1036, Type I, Class 1 (clear), Quality q3.

      1) Kind FT (Full Tempered)
      2) 1/4-inch thick glass.

d. Performance Requirements: (minimum requirements based on non-tinted clear glass)

1) Visible Light Transmittance: 64 percent minimum.
2) Winter Nighttime U-Factor: 0.24 (Btu/hr*ft^2*°F) maximum.
3) Summer daytime U-Factor: 0.21 (Btu/hr*ft^2*°F) maximum.
4) Shading Coefficient: 0.31 maximum.
5) Solar Heat Gain Coefficient: 0.27 maximum.
6) Outdoor Visible Light Reflectance: 13 percent maximum.

3. **High Performance Reflective Insulating Glass**: Formed of two 1/4-inch lites of glass separated by a 1/2-inch Argon Gas filled space hermetically sealed, for a total 1 inch nominal thickness conforming to ASTM E 2190, consisting of:

a. Outer Lite: ASTM C1036, Type I, Class 1 (tint - color as selected by architect), Quality q3.

1) Kind FT (Full Tempered)
2) 1/4-inch thick glass.
3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376.
4) Coating: “Solarcool” by Vitro Architectural Glass on second surface (2).

b. Interspace Content: Air (10%) / Argon (90%) Mix 1/2" (12.7mm).

c. Inside Lite: ASTM C1036, Type I, Class 1 (clear), Quality q3.

1) Kind FT (Full Tempered)
2) 1/4-inch thick glass.
3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376
4) Coating: “Solarban” 70 Solar Control Low-E (Sputtered) by Vitro Architectural Glass on the third surface (3).

d. Performance Requirements: (minimum requirements based on Solarbronze glass)

1) Visible Light Transmittance: 17 percent minimum.
2) Winter Nighttime U-Factor: 0.24 (Btu/hr*ft^2*°F) maximum.
3) Summer daytime U-Factor: 0.22 (Btu/hr*ft^2*°F) maximum.
4) Shading Coefficient: 0.20 maximum.
5) Solar Heat Gain Coefficient: 0.17 maximum.
6) Outdoor Visible Light Reflectance: 14 percent maximum.

4. **High Performance Spandrel Insulating Glass**: Formed of two 1/4-inch lites of glass separated by a 1/2-inch Argon Gas filled space hermetically sealed, for a total 1 inch nominal thickness conforming to ASTM E 2190, consisting of:

a. Outer Lite: ASTM C1036, Type I, Class 1 (tint - color as selected by architect), Quality q3.

1) Kind FT (Full Tempered)
2) 1/4-inch thick glass.
3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376.
4) Coating: “Solarban” 70 Solar Control Low-E (Sputtered) by Vitro Architectural Glass on the second surface (2).

b. Inside Lite: ASTM C1036, Type I, Class 1 (clear), Quality q3.

1) Kind FT (Full Tempered)
2) 1/4-inch thick glass.
3) Monolithic coating on the fourth surface (4), provide coating on the third surface (3)

when glazing is exposed to the inside.

4) Coating: “OPACI-COAT 300” by ICD High Performance Coatings, 7350 South Union Ridge Parkway, Ridgefield WA 98642. 360.546.2286 phone - 360.546.2287 fax; icd@icdcoatings.com; http://www.icdcoatings.com/

c. Performance Requirements: (minimum requirements based on non-tinted clear glass)

1) Visible Light Transmittance: 64 percent minimum.
2) Winter Nighttime U-Factor: 0.24 (Btu/hr*ft^2*°F) maximum.
3) Summer daytime U-Factor: 0.21 (Btu/hr*ft^2*°F) maximum.

5. **High Performance Insulating Skylight Glass**: (to be used at all glass skylights and horizontal glass applications) Formed of one 1/4-inch lite of tempered glass and one 5/16-inch inch lite of laminated glass separated by a 1/2-inch Argon Gas filled space hermetically sealed, for a total 1-3/16 inch nominal thickness conforming to ASTM E 2190, consisting of:

a. Outer Lite: ASTM C1036, Type I, Class 1 (tint - color as selected by architect when required), Quality q3.

1) Kind FT (Full Tempered)
2) 1/4-inch thick glass.
3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376.
4) Coating: “Solarban” 70 Solar Control Low-E (Sputtered) by Vitro Architectural Glass on the second surface (2).

b. Indoor Lite: Laminate: ASTM C1172 and complying with testing requirements.

1) Laminate Outboard Lite: ASTM C1036, Type I (transparent), Class 1 (clear), Quality q3.

a) Kind FT (Full Tempered)
b) 1/4-inch thick glass.

2) Interlayer: ASTM C1036, Type I, Class 1, Quality q3.

a) Type: PVB
b) Thickness: 0.015” (0.38mm)”

3) Laminate Inboard Lite: ASTM C1036, Type I (transparent), Class 1 (clear), Quality q3.

a) Kind FT (Full Tempered)
b) 1/4-inch thick glass.

c. Performance Requirements: (minimum requirements based on non-tinted clear glass)

1) Visible Light Transmittance: 58 percent minimum.
2) Winter Nighttime U-Factor: 0.22 (Btu/hr*ft^2*°F) maximum.
3) Summer daytime U-Factor: 0.14 (Btu/hr*ft^2*°F) maximum.
4) Shading Coefficient: 0.30 maximum.
5) Solar Heat Gain Coefficient: 0.26 maximum.
6) Outdoor Visible Light Reflectance: 13 percent maximum.

2.06 GLAZING MATERIALS AND ACCESSORIES

A. General:

1. Provide black exposed glazing materials, unless another color is indicated, or unless another color is selected by the Architect from manufacturer's standard colors. Provide hardness of materials as recommended for the required application and condition of installation in each case. Provide only compounds, which are known (proven) to be fully compatible with surface contacted.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Glazing Tape: Butyl-based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for specified installation, complying with ASTM C 1281 and AAMA 800 for application.

D. Glazing Gaskets:

1. Dense Compression Gaskets: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone or thermoplastic polyolefin rubber, as recommended by glazing product manufacturer for application, molded or extruded shape to fit glazing channel retaining slot; black color.

2. Soft Compression Gaskets: ASTM C 509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal.

E. Setting Blocks: ASTM C 864, neoprene, 80 to 90 Shore A durometer hardness; length 4 inches, width of glazing rabbet space less 1/16 inch, height required for glazing method, pane weight, and pane area.

F. Spacer Shims: ASTM C 864, neoprene, 50 to 60 Shore A durometer hardness; length 3 inches, one half height of glazing stop, thickness required for application, one face self-adhesive.

G. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

H. Glazing Sealants: ASTM C 920, type recommended by glazing product manufacturer for application indicated, complying with requirements of Section 079200 – Joint Sealants, color as selected by Architect.

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.

4. For Glazing Interior Openings:

a. Acrylic latex one-part terpolymer (FS TT-00230) or acrylic latex emulsion (ASTM C-834), compounded specifically as glazing sealant with permanent flexibility (non-hardening), non-staining, and non-bleeding.

b. Products complying with these requirements include:

1) "AC-20" by Pecora Corp., Harleysville, Pennsylvania.
2) "MONO" by Tremco, Inc., Cleveland, Ohio.
3) "Krylflex" by Chem-Masters Corp., Chagrin Falls, Ohio.

5. For Glazing Exterior Openings, except where gasket is used:

   a. Silicone sealant, complying with FS TT-S-001543, Class A, non-sag, compounded for glazing applications.

   b. Products complying with these requirements include:

      1) "Dow Corning 999 Silicone Building and Glazing Sealant" by Dow Corning Corp., Midland, Michigan.

      2) "Silicone Construction Sealant 1200" by General Electric Co., Silicone Products Div., Waterford, New York.

6. For Glazing Glass to Glass:

   a. Structural Silicone sealant, complying with ASTM C1401-09a, Standard Guide for Structural Sealant Glazing.

   b. Products complying with these requirements include:

      1) "Dow Corning 993 Structural Glazing Silicone Sealant" by Dow Corning Corp., Midland, Michigan.
      2) "Dow Corning 3362 Insulating Glass Silicone Sealant" by Dow Corning Corp., Midland, Michigan.

I. Compressible Filler Rod:

   1. Closed cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that glazing channels are clean, free of burrs, irregularities, and debris and ready to accept glazing installation, and that weeps are unobstructed. Confirm that minimum required face and edge clearances will be maintained.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Examine glazing units prior to setting. Reject units that display edge or face damage that may impede performance of unit or that will be visible when installed.

3.02 PREPARATION

A. Field Measurements:

   1. Cut glass accurately to sizes obtained from actual verified field measurements of frames to receive glass.

2. Allow for proper edge clearances.

B. Preparation of Surfaces:

1. Remove any protective coatings or covering from surfaces to be glazed.

2. Clean glass and glazing surfaces to remove dust, oil and contaminants, and wipe dry.

3. Clean glazing channels and other framing members receiving glass immediately before glazing with recommended solvent and wipe dry. Remove coatings not firmly bonded to substrates.

4. Apply primers to joint surfaces to ensure adhesion of sealants, unless preconstruction sealant-substrate testing indicates no primer is required.

3.03 GENERAL PROVISIONS

A. Exterior Glazing Only:

1. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss of breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

2. Weather conditions:

a. Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer’s recommended limitations for installation.

B. Interior and Exterior glazing:

1. Protect glass from edge damage at all times during handling, installation, and operation of the building.

2. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thickness, with reasonable tolerances. The installer is responsible for correct glass size for each opening, within the tolerances and necessary dimensions established.

3. The installer must examine the framing or glazing channel surfaces, backing, stop design, and the conditions under which the glazing is to be performed, and notify the Prime Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.04 GLAZING INSTALLATION

A. Verify by measurements at the job site all dimensions affecting this work.

B. Comply with combined recommendations of glass manufacturer and manufacturer of sealants, gaskets, and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturers' technical representatives direct otherwise.

C. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust

as required by Project conditions during installation. Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coating which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

D. Do not attempt to cut, seam, nip, or abrade glass that is tempered, heat strengthened, or coated.

E. Inspect each piece of glass immediately before installation, and eliminate any which have observable edge damage or face imperfections. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

F. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

G. Glass shall be set without springing or forcing and carefully centered laterally and vertically so as to provide uniform clearance. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Install glass and glazing materials in accordance with instructions of manufacturers and requirements of GANA Glazing Manual.

1. Install setting blocks of proper sizes at quarter points of sill rabbet. Set blocks in thin course of heelbead compound / sealant, if any.

2. Provide spacers inside and out, and of proper size and spacing, for all glass sizes where the length plus width is larger than 50 united inches, except where gaskets are used for glazing.

3. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

4. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

5. Ensure that glazing units are set with proper and consistent orientation of glass units toward interior and exterior.

6. Provide edge blocking where recommended.

7. Install sealants in accordance with requirements of Section 079200 – Joint Sealants.

8. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, drawn, and bow oriented in the same direction as other pieces.

9. Clearance Requirements: Allow the following minimum nominal clearances, in accordance with glass manufacturer's recommendations; glass face to channel face, glass edge to frame member, and glass bite:

Glass Thickness	Face Clearance	Edge Clearance	Bite
Up to 1/4 - inch	1/8 - inch	1/4 - inch	1/4 - to 3/8-inch
5/16 - to 3/8-inch	3/16 - inch	5/16 - inch	5/16 - to 7/16-inch
1/2 - to 13/16-inch	1/4 - inch	3/8 - inch	1/2 - to 5/8-inch
7/8 - inch and over	1/4 - inch	1/2 - inch	1/2 - to 7/8-inch

3.05 GLASS TO GLASS JOINTS

A. Where glass panels join without mullion, bed joint with clear silicone sealing compound. For exterior applications a structural silicone bond joint is required. All materials to be joined must be compatible and meet the sealant manufacturer's requirements for adhesion & design loading.

B. Edgework requirements for butt joint glazing applications shall be reviewed and approved by the architect prior to field installation due to a variation in edge quality based on the size, shape and thickness of the glass.

C. Factory clean cut edges shall meet the following recommendations for butt joint glazing applications:

1. 3/8" glass is acceptable for use with factory clean cut edges.
2. 1/2" glass up to a maximum length of 100" on the butt joint edge can be used with factory clean cut edges.
3. 1/2" glass over 100" in length and 5/8" and thicker glass in any length should not be used with a factory clean cut edge.

3.06 SEALANT APPLICATION

A. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

B. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

C. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

D. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

3.07 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.08 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to proper lengths prior to application, install against permanent stop, 3/16-inch to 1/4-inch below sightline.

B. Do not lap the adjoining lengths of tape or rubber shim, as this will prevent full contact around perimeter of glass:

1. Strips must be installed in four separate sections, not run continuously around corners.

C. Place setting blocks at 1/4 points.

D. Rest glass on setting blocks and press against tape with sufficient pressure to ensure full contact and adhesion at perimeter.

E. Install removable stops; insert continuous spacer strips between glass and applied stop to keep glass in compression against the tape.

1. Install in four separate sections.

F. Sealant cavity pocket, formed by setting of the applied stop, shall then be filled to the sight line with sealant.

G. Cap bead shall not exceed 1/16 inch above sight line onto glass surface.

H. Tool or wipe cap bead with solvent for smooth appearance.

3.09 INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and install against permanent stop, projecting 1/16-inch above sightline.

B. Place setting blocks at 1/4 points.

C. Rest glass on setting blocks and push against stop for full contact and adhesion at perimeter.

D. Place glazing tape on free perimeter of glass in same manner described above.

E. Install removable stop, avoid displacement of tape, exert pressure on tape for full continuous contact.

F. Knife trim excess or protruding tape.

3.10 CLEANING AND PROTECTION

A. Protect exterior glass from breakage immediately upon installation by attachment of crossed streamers to framing held away from glass. DO NOT APPLY MARKERS OF ANY TYPE TO SURFACES OF GLASS. Remove nonpermanent labels, and clean surfaces.

B. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in any other way during the construction period, including natural causes, accidents, and vandalism. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Remove all excess glazing material from all installed glass. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other surfaces. Any soiling occurring on the glass shall be promptly and completely washed off.

D. Carefully and completely remove all markings and labels from glass surfaces. Do not apply markers to glass surfaces.

E. Wash and polish glass on both faces with a mild neutral or slightly acidic solution as recommended by the glass manufacturer not more than four days prior to Owner's acceptance of the work in each area. Attach crossed streamers away from glass face.

F. Care shall be taken during cleaning to avoid scratching of glass surfaces by grit particles.

G. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

H. Within 5 working days prior to inspection for Substantial Completion, clean all exposed glass surfaces using methods recommended by manufacturer. Remove glazing compounds from framing surfaces.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 088200 – METAL WINDOW PANELS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes:

1. Supply and installation of all smooth aluminum faced composite panels.

B. Related Documents:

1. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to the work of this section.

C. Related Work Specified Elsewhere:

1. Section 051200 – Structural Steel Framing
2. Section 061000 – Rough Carpentry
3. Section 072100 – Building Insulation
4. Section 076000 – Flashing and Sheet Metal
5. Section 079200 – Joint Sealants
6. Section 084113 – Aluminum Entrances and Storefront
7. Section 088413 – Glazed Aluminum Curtain Walls
8. Section 085113 – Aluminum Windows
9. Section 092900 – Gypsum Wallboard
10. Section 099000 – Painting

1.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide panels as shown on drawings for installation in new/existing window systems, including required accessories for complete installation.

2. The extent of the panel system work is indicated on the contract drawings and within these specifications.

1.03 SUBMITTALS

A. Comply with requirements of Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit manufacturer's product literature, product specifications, test reports, installation instructions, and similar data required to demonstrate compliance with specified requirements.

C. Samples:

1. Panel makeup - 2 samples - 10" x 10".
2. Two samples of each color and finish texture - 3" x 5” for color selection by Architect.

D. Quality Control Submittals:

1. Certificates: Submit certification or letter from panel manufacturer certifying materials meet all requirements as specified.

E. Submission Drawings: Indicate thickness, dimension and components of parts. Detail glazing methods, framing and tolerances to accommodate thermal movement.

F. Code Compliance: Submit documents showing product compliance with the national and local building code. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.

G. Contract Closeout Submittals:

1. Comply with requirements of Section 017000, including submission of maintenance instructions as item in "General Construction Instructions" manual described in that section.

1.04 QUALITY ASSURANCE

A. Standards: Comply with the provisions of the standards listed below and the applicable standards listed in Section 014219 (including all revisions of contract to date):

1. American Society for Testing and Materials (ASTM):

a. E330-84: Structural Performance of Exterior Windows, Curtain Walls and Doors under the influence of wind loads.
b. D1781-76: Climbing Drum Peel Test for Adhesives.
c. D2794-90: Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
d. D3359-90: Method for Measuring Adhesion by the tape test.
e. D3363-74: Method for Film Hardness by Pencil Test.

2. Composite panel manufacturers shall have established a Certification Program acceptable to local Code Authorities.

B. Qualifications of Manufacturer: Panel manufacturer shall have a minimum of 25 years experience.

C. Field measurements shall be taken prior to completion of manufacturing and cutting.

D. Maximum deviation from vertical and horizontal alignment of installed panels is 1/8" (3mm) in 20' (6m) non-commutative.

E. Manufacturer's Certification: Prior to start of installation of the work of this section, secure visits to the job site by a representative of the manufacturer who shall inspect and certify that:

1. The openings in which the work of this section will be installed are all in condition suitable for installation.

2. The materials to be installed comply in all respects with the requirements of this section of these specifications.

3. The materials will be installed in complete accordance with the manufacturer's specifications.

F. Coordinate fabrication schedule with construction progress schedule as directed by the contractor, to avoid all delays of the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Ship panels with finished surfaces and edges protected from damage in accordance with manufacturer's recommendations.

B. Storage and Protection:

1. Store panels at site unit ready for installation in storage areas complying with manufacturer's recommendations.

1.06 PROJECT/SITE CONDITIONS

A. Field Measurements:

1. Take field measurements of existing windows before panel fabrication to verify required dimension and details. Review any discrepancies from Contract Documents found with Architect before proceeding with the fabrication. Coordinate the fabrication schedule with the construction schedule so as not to delay the progress of the work.

1.07 WARRANTY

A. Provide panel manufacturer's limited warranty for a minimum of 20 years providing that standard Kynar finish, under normal atmospheric conditions, will not exhibit excessive fading of color, crazing, cracking, or flaking.

1. Manufacturer's obligation shall include repair or replacement of defective panels.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For convenience, details and specifications have been based on “Mapes-R” glazing panels as manufactured by Mapes Industries, Inc., Lincoln, Nebraska.

B. Acceptable alternatives: Panels having similar composite construction and finish providing manufacturer has a minimum of 25 years panel laminating experience and comparable published warranties.

C. Total Panel Thickness shall be **2”**, nominal, 5-Ply construction, consisting of the following materials:

2.02 PANEL FABRICATION AND FINISH

1. Face Material (to exterior side): .032 thick, smooth aluminum skin with Standard Kynar Finish.

2. Exterior Back Substrate: min. 3/16” thick asbestos-free cement board

3. Insulating Core: 2.05 lb. density polyisocyanurate

4. Interior Back Substrate: 3/16” Tempered Hardboard

5. Interior Back Material: .032 thick, smooth aluminum skin with Standard Kynar Finish.

6. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness.

7. Panel Thickness: 2”

8. Total Panel R-Value: 13.61

9. U-Value - 0.07

2.03 ACCESSORIES

A. Recommended for use as an infill panel component in window and curtain wall systems. Related material to complete installation as recommended by the manufacturer.

B. Sealant: Seals against moisture intrusion as recommended by the manufacturer. Polyurethane and silicone based sealant with a 20 year life are recommended.

1. Manufacturer's offering suitable products include:

a. The Dow Chemical Company, Midland, Michigan.
b. GE Silicones, General Electric Company, Waterford, New York.

C. Setting Blocks: Elastomeric setting blocks as recommended by panel manufacturer.

D. Sealant Tape: 100 percent solid butyl-based extruded sealant tape; similar or equal to "MBR-35" by Tremco, Cleveland, Ohio.

2.04 FABRICATION

A. Panel components shall be factory-laminated into a single, monolithic unit in factory, using permanently elastic type neoprene or rubber based adhesive recommended by panel manufacturer applied over 100 percent of surface area using heat and pressure to develop adhesive bonding strength equal to, or greater than, internal bonding strength of components.

B. Shop/Factory Finishing: Apply protective coverings to all finished surfaces before the panels leave the factory.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions (by Installer):

1. Examine conditions under which composite insulating panels are to be installed and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION

A. Comply with manufacturer's installation instructions and recommendations. All panels are to be erected plumb, level and true. All panels shall be erected in accordance with an approved set of shop drawings.

1. Obtain the panel manufacturer's written approval methods for installation of panels into new window systems.

B. Glaze panels securely and in accordance with approved shop drawings and manufacturers instructions to allow for necessary thermal movement and structural support.

C. Do not install panels that are observed to be defective including warped, bowed, dented, scratched and delaminating components.

D. Unless otherwise recommended by the panel manufacturer or window manufacturer, provide setting blocks at quarter points of each panel. Conform to the panel fabricator's instructions for installation of concealed fasteners.

E. Apply sealant tape around perimeter of window opening inside glazing rabbet to receive panels. Install panels carefully to ensure tape is not damaged or dislodged and that panel is tightly set against tape.

F. Separate dissimilar metals using gasketed fasteners and blocking to eliminate the possibility of electrolytic reaction.

G. Provide for thermal expansion in assembly of groups of units.

H. Seal around the perimeter of the panels between panel and window frame with sealant in accordance with sealant manufacturer's application instructions. Weatherseal all joints as required using methods and materials as previously specified.

3.03 ADJUSTING / CLEANING

A. Clean all panel surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances.

B. Remove and replace panels damaged beyond repair as a direct result of the panel installations. After installation, panel repair and replacement shall become the responsibility of the Contractor.

C. Repair panels with minor damage to the satisfaction of the Architect; replace unacceptably-repaired panels as directed by the Architect at no additional cost to the Owner.

D. Remove masking film as soon as possible after installation. Masking intentionally left in place after panel installation will be the responsibility of the Contractor.

E. Any additional protection, after installation, shall be the responsibility of the Contractor.

F. Ensure that all weep holes & drainage channels are unobstructed and free of dirt and sealants.

G. Final clean all areas affected by the work of this scope to the satisfaction of the Owner and the Architect.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 088723 – SECURITY WINDOW FILM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Safety and Security Window Film (Ultra S800):

1. This specification is for an optically clear glass shatter resistant and abrasion resistant window film which, when applied to the interior window surface, will help hold broken glass together and reduce the ultra-violet light that normally would enter through the window. This is an easily applied, tear-resistant safety and security window film designed to provide an increased measure of protection in a broad range of uses including basic glass fragment retention, spontaneous glass breakage, seismic preparedness, safety glazing, bomb blast mitigation, Smash and Grab or Break and Entry events.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

C. Related work specified elsewhere:

1. Section 072100 – Building Insulation
2. Section 079200 – Joint Sealants
3. Section 081113 – Hollow Metal Doors and Frames
4. Section 081416 – Flush Wood Doors
5. Section 081433 – Stile and Rail Doors
6. Section 084113 – Aluminum Entrances and Storefronts
7. Section 084413 – Glazed Aluminum Curtain Walls
8. Section 085113 – Aluminum Windows
9. Section 085200 – Ultimate Double Hung Wood Windows

1.02 REFERENCE STANDARDS

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

B. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.

C. ASTM International (ASTM):

1. ASTM E 308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
2. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
3. ASTM D 882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
4. ASTM D 1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
5. ASTM D 2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
6. ASTM D 4830 - Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing.
7. ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-

metallic Materials Using Concentrated Natural Sunlight.
8. ASTM G 26 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.
9. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
10. ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
11. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
12. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
13. ASTM F 1642 - Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings
14. ASTM F 2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings.

D. Consumer Products Safety Commission 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.

E. GSA-TS01-2003 General Services Administration Standard Test for Glazing and Glazing Systems Subject to Airblast Loadings.

F. Berkeley Lab WINDOW A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory.

1.03 DEFINITIONS

A. Light to Solar Gain Ratio: The ratio of visible light transmission to Solar Heat Gain Coefficient.

1.04 DESIGN PERFORMANCE

A. Safety Glazing Impact Performance:

1. 400 ft-lb impact requirements of 16 CFR 1201 (Category 2) and ANSI Z97.1 (Class A, Unlimited). Testing shall be done with film applied both on 1/8” and 1/4” annealed glass.

B. Bomb Blast Mitigation:

1. GSA Rating of “3a” / ASTM F1642 “Minimal Hazard” with target blast pressure of 6 psi and 42 psi*msec blast impulse, on ¼” annealed single pane glass and 3M Impact Protection Attachment Sealant
2. GSA Rating of “3a” / ASTM F1642 “Low Hazard” with blast pressure of 7.5 psi and 55 psi*msec blast impulse, on ¼” annealed single pane glass and 3M Impact Protection Attachment Sealant
3. GSA Rating of “2” / ASTM F1642 “Minimal Hazard” with target blast pressure of 6 psi and 42 psi*msec blast impulse, on 1” annealed double pane glass with 3M Impact Protection Attachment Sealant
4. GSA Rating of “3b” / ASTM F1642 “Low Hazard” with target blast pressure of 9 psi and 70 psi*msec blast impulse, on 1” annealed double pane glass with 3M Impact Protection Attachment Sealant
5. GSA Rating of “2” / ASTM F1642 “Minimal Hazard” with target blast pressure of 9 psi and 70 psi*msec blast impulse, on 1” tempered double pane glass with 3M Impact Protection Attachment Sealant
6. GSA Rating of “2” / ASTM F1642 “Minimal Hazard” with target blast pressure of 10 psi and 75 psi*msec blast impulse, on 1” tempered double pane glass with 3M Impact Protection Attachment Sealant
7. GSA Rating of “3a” / ASTM F1642 “Very Low Hazard” with target blast pressure of 6.8 psi and

47 psi*msec blast impulse, on 1” tempered double pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only)

8. GSA Rating of “3a” / ASTM F1642 “Very Low Hazard” with blast pressure of 6.5 psi and 40 psi*msec blast impulse, on ¼” tempered single pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only).

C. GSA Rating only:

1. GSA Rating of “2” with blast pressure of 7.6 psi and 51 psi*msec blast impulse, on ¼” tempered single pane glass with 3M Impact Protection Attachment Sealant.
2. GSA Rating of “3b” with blast pressure of 6.84 psi and 45 psi*msec blast impulse, on 1” annealed double pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only).

D. Impact Protection:

1. Film shall pass impact of Large Missile “C” and withstand subsequent pressure cycling (per ASTMs E1996 and E1886) at +/- 75 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system.

E. Tear Resistance:

1. Minimum Graves Area Tear Strength of 1,200 lbs% as measured on coated film product, without liner, per ASTM D1004.

F. Adhesion to Glass:

1. Film shall have a 180-degree peel strength (adhesion to glass) according to ASTM D-1044 of 6 lbs/in (typical).

G. Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be pressure sensitive (not water activated) and physically bond (not chemically bond) to the glass. The adhesive shall be essentially optically flat and shall meet the following criteria:

1. Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
2. It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substance in order to prevent moisture or free water from penetrating under the film system.

H. Flammability: Window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E-84:

1. Flame Spread Index (FDI): 5.
2. Smoke Developed Index (SDI): 25.

I. Abrasion Resistance:

1. Film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

J. UV Light Rejection:

1. Minimum of 99.9% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film

applied on 1/4 inch clear glass.

K. Solar Performance Properties: film applied to ¼" thick clear glass.

1. Visible Light Transmission (ASTM E 903): 88%
2. Visible Reflection (ASTM E 903): not more than 10%
3. Ultraviolet Transmission (ASTM E 903): less than 1% (300-380 nm)
4. Solar Heat Gain Coefficient (ASTM E 903): 0.80

1.05 SUBMITTALS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Manufacturer's current technical literature on each product to be used, including:

1. Manufacturer's Data Sheets.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. 3rd Party Test Report Submittal Requirements. Submit the following 3rd Party test reports indicating compliance with the test values listed in this section:

1. Flammability Testing, ASTM E84.
2. Film Properties Testing, ASTM D882.
3. Abrasion Resistance Testing, ASTM D1044.
4. Peel Strength Testing, ASTM D3330.
5. Tear Resistance Testing, ASTM D1004.
6. Puncture Strength Testing, ASTM D4830.
7. Safety Glazing Impact Testing, ANSI Z97.1 and/or 16 CFR 1201.
8. Impact Resistance and Pressure Cycling, ASTMs E1886 and E1996.
9. Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003.

D. Other Product Submittals:

1. Manufacturer's summary of 3rd Party Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003
2. 3rd Party test reports from Forced Entry Resistance evaluations.

E. Verification Samples: For each film specified, two samples representing actual film color and pattern.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

1. Provide documentation that the adhesive used on the specified films is a Pressure Sensitive Adhesive (PSA).

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

1. Provide documentation that the installer is authorized by the Manufacturer to perform Work

specified in this section.

2. Provide a commercial building reference list of 10 properties where the installer has applied window film. This list will include the following information:

    a. Name of building.
    b. The name and telephone number of a management contact.
    c. Type of glass.
    d. Type of film and/or film attachment system.
    e. Amount of film and/or film attachment system installed.
    f. Date of completion.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE & HANDLING

A. Follow Manufacturer's instructions for storage and handling.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.09 WARRANTY

A. Warrant the film for a period of 12 years (14 years installed with 3M Impact Protection Attachment Sealant) from the date of installation against cracking, crazing, delaminating, peeling, or discoloration. If the product is found to be defective under warranty, manufacturer shall replace such quantity of the film proved to be defective and will additionally provide the removal and reapplication labor free of charge at current industry labor rates.

B. Warrant against glass failure due to thermal shock fracture of the glass window unit (maximum value $500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the date of application. Any glass failure must be reviewed and approved by manufacture prior to replacement and payment.

C. In order to validate warranty, installation must be performed by an Authorized 3M dealer and according to Manufacturer's installation instructions. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:
3M Commercial Solutions Division
3M Center, Building 280
St. Paul, MN 55144-1000
Toll Free Tel: 888-650-3497; Tel: 651-737-1081; Fax: 651 737 8241;
Email:request info (vkampmeyer@mmm.com);
Web: https://www.3m.com/3M/en_US/p/d/b40028256/

2.02 CLEAR MICROLAYERED SAFETY AND SECURITY WINDOW FILM

A. 3M Scotchshield Ultra S800 Safety and Security Window Film. The film material shall consist of an optically clear polyester film, consisting of co-extruded micro- layers, with a durable acrylic abrasion resistant coating over one surface, and a UV stabilized pressure sensitive adhesive on the other. The film color is clear and will not contain dyed polyester. The film shall have a nominal thickness of 8 mils (0.008 inches), total construction with adhesive of 9mils (0.009 inches). There shall be no evidence of coating voids.

1. Physical / Mechanical Performance Properties (nominal):

   a. Film Color: Clear.

   b. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils

   c. Tensile Strength (ASTM D882):

      1) Coated Film: 33,000 psi (MD) / 30,000 psi (TD).

   d. Break Strength (ASTM D882):

      1) Coated Film: 265 lb/in (MD) / 240 lb/in (TD).

   e. Percent Elongation at Break (ASTM D882):

      1) Coated Film: 140 % (MD) / 130 % (TD).

   f. Yield Strength:

      1) Coated Film: 15,000 psi (MD).

   g. Percent Elongation at Yield (ASTM D882):

      1) Coated Film: 8% (MD).

   h. Graves Tear Resistance (ASTM D1004):

      1) Maximum Force (lbs):

         a) Coated Film: 37 (MD) / 37 (TD).

      2) Maximum Extension (in):

         a) Coated Film: 0.50 (MD) / 0.51 (TD).

3) Graves Area Tear Resistance (lbs%):

a) Coated Film: 1,100 (MD) / 1,050 (TD).

i. Puncture Propagation Tear Resistance (ASTM D2582):

1) Coated Film: 10 lbf (MD) / 12 lbf (TD).

j. Puncture Strength (ASTM D4830):

1) Coated Film: 183 lbf.

2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.

3. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.

4. Identification: Labeled as to Manufacturer as listed in this Section.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine glass surfaces to receive new film and verify that they are free from defects and imperfections, which will affect the final appearance. Correct all such deficiencies before starting film application.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Refer to Manufacturer's installation instructions for methods of preparation for Impact Protection Adhesive or Impact Protection Profile film attachment systems.

D. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be scraped with stainless steel razor blades with clean, sharp edges to ensure the removal of any foreign contaminants without damages the glass surface.

E. Drop cloths or other absorbent material shall be placed on the windowsill or sash to absorb moisture accumulation generated by the film application.

3.03 INSTALLATION

A. Film Installation, General:

1. The film shall be applied as to the specifications of 3M.

2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.

3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1

gallon of water, on window glass and adhesive to facilitate proper positioning of film.

4. Apply film to glass and lightly spray film with slip solution.

5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.

6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.

7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

8. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

B. Impact Protection Adhesive Installation:

1. The film attachment system shall be applied according to the specifications of the Manufacturer by an Authorized Dealer/Applicator. Refer to 3M publication, 70-0709-0322-7, 3M Impact Protection Adhesive Attachment System Installation Instructions.

   a. For blast mitigation: minimum 1/2 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).

   b. For windborne debris protection: minimum 3/8 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).

2. To ensure a straight and consistent bead width is achieved, masking tape may be applied to film and frame surfaces prior to application.

3. With prior approval of the building owner or property manager, existing compression gaskets may be partially removed or trimmed to allow for a thinner bead and stronger anchorage. If removing the gaskets, sections shall be trimmed approximately 3 inches in length and inserted with appropriate spacing along all sides of the window to help secure the glazing during application and curing of the Impact Protection Adhesive.

4. The Impact Protection Adhesive shall be dispensed with a caulk gun with nozzle opening diameter sized to match the approximate size of the desired bead width.

5. A plastic putty knife or other tool with a clean straight edge shall be used to trowel and smooth out the adhesive. The completed adhesive bead shall be relatively triangular in shape.

6. Any masking tape used shall be carefully removed within 10 minutes after applying the wet glaze.

C. Impact Protection Profile Installation:

1. The film attachment system shall be applied according to the specifications of the Manufacturer by an Authorized Dealer/Applicator trained to install 3M Impact Protection Profile. Refer to 3M publication, 70-0709-0323-5, 3M Impact Protection Profile Attachment System Installation Instructions.

2. Each profile piece shall span continuously to both sides of the window, within 1/8 inch to the frame edge. Splicing the profile between frame edges is prohibited.

3. Profile shall be aligned and applied by 3M recommended or approved methods and tools to ensure a quality installation.

4. Corner joints shall be fabricated by 3M recommended and approved methods. No part of the profile adhesive shall make contact with an adjacent profile.

5. Sufficient pressure shall be evenly applied along the entire length of the profile to ensure full adhesion from both adhesive strips. A roller tool is required to minimize entrapment of air in the adhesive.

3.04 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION

DIVISION 08 – OPENINGS

SECTION 088813 – FIRE RATED GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 WORK INCLUDED

A. Fire-rated glazing materials installed as vision lights in fire-rated doors.

B. Fire-rated glazing materials installed as transoms, borrowed lites and windows in fire-rated frames.

C. For non-rated assemblies, see Specification Section 088000 – Glazing.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 079200 – Joint Sealants
B. Section 081166 – Hollow Metal Doors and Frames
C. Section 081416 – Flush Wood Doors
D. Section 081433 – Stile and Rail Doors

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM E2010-01 – Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
2. ASTM E2074-00 – Standard Test Method for Fire Tests of Door Assemblies, including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
3. ASTM E163 – Methods for Fire Tests of Window Assemblies.
4. ASTM E773 – Test Method for Seal Durability of Sealed Insulating Glass Units.
5. ASTM E838 – Cracking, Blistering, Crazing and Color Change.
6. ASTM E 119 – Fire Tests of Building Construction and Materials.

B. American National Standards Institute (ANSI):

1. ANSI Z97.1 – Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201 – Safety Standard for Architectural Glazing Materials

D. Glass Association of North America (GANA):

1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

E. National Fire Protection Association (NFPA):

1. NFPA 80 – Fire Doors and Windows.

2. NFPA 252 – Fire Tests of Door Assemblies.
3. NFPA 257 – Fire Tests of Window Assemblies.

F. Underwriters Laboratories, Inc. (UL):

1. UL 9 – Fire Tests of Window Assemblies.
2. UL 10B – Fire Tests of Door Assemblies.
3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.

G. Building Code of New York State

1.05 PERFORMANCE REQUIREMENTS

A. FireLite Plus® - Fire-rated glass ceramic laminated clear and wireless glazing material for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with hose stream test.

B. Fireglass20® - Fire-rated tempered glass clear and wireless glazing material for use in impact safety-rated locations with fire rating requirements of 20 minutes without hose stream test; for use in interior and exterior applications.

C. Pyrostop® - Fire-rated, clear and wireless glazing material for use in locations such as doors, sidelites, transoms, borrowed lites, and wall applications with fire rating requirements ranging from 45 minutes to 2 hours with required hose stream test; for use in interior and exterior applications.

D. Product shall pass positive pressure tests standards: UL 10C, UBC 7-2 and UBC 7-4.

E. Safety Glazing: Comply with testing requirements of CPSC 16 CFR 1201, safety regulation for architectural glazing in hazardous locations for Category I & II materials.

1.06 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data – Glass:

1. Submit manufacturer's technical data, specifications, and installation and maintenance instructions for each type of glass required. Include test data substantiating that glass complies with specified requirements.

2. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

C. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.

D. Samples:

1. Submit three (3) 8" x 10" samples of each type of glass required. Architect's review of samples will be for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

E. Shop Drawings: Prior to placement of glass order or glass fabrication, the Contractor shall pertinent shop drawings (i.e. – windows, doors, borrowed light frames, etc.) which have been:

1. Checked and approved by the General Contractor, stamped and dated.
2. Reviewed by the Architect, with stamp affixed.

1.07 QUALITY ASSURANCE

A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.

B. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL and/or WHI certifying it for use in tested and rated fire protective assemblies.

C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152 and UL 10B, labeled and listed by UL and/or WHI or other certification agency acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Deliver all materials to project site in manufacturer's original packaging, undamaged, complete with installation instructions.

C. Store off ground, under cover, protected from weather and construction activities.

D. Pilkington Pyrostop® must not be exposed outside the range -40 degrees F to 120 degrees F (-40 degree C to +50 degrees C) during storage and transportation. Do not expose the non-PVB side of glass to UV light.

E. Glass that is cracked, broken, chipped, or otherwise damaged during transportation, storage, and erection, and all glazing and sealing materials unfit for use shall be removed from the job site and replaced with acceptable materials at the Contractor's expense.

F. All Glazing broken or damaged during construction up to the date of substantial completion shall be removed from the job site and replaced with acceptable materials at the Contractor's expense.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS - GLASS

A. FireLite Plus® as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-425-396-8300, e-mail sales@fireglass.com, web site www.fireglass.com

1. FireLite Plus® glazing sizes shall be as shown on the drawings:

2. Properties: All fire rated ceramic glass designated on the drawings shall carry the following properties:

   a. Thickness: 5/16 inch.
   b. Weight: 4.0 lbs. / sq.ft.
   c. Approximate Visible Transmission: 85 percent.
   d. Approximate Visible Reflection: 9.0 percent.
   e. Fire-Rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications – refer to Contract Drawings for ratings.
   f. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
   g. STC Rating: Approximately 38 dB.
   h. Surface Finish: Standard Grade is polished for a surface quality that is comparable to alternative fire-rated ceramics marketed as having a “premium” finish.
   i. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.

3. Maximum sheet sizes based on surface finish: Standard 48 inches by 96 inches.

4. Labeling: Each piece of FireLite Plus® shall be permanently labeled with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite® label only for sizes that exceed the listing. FireLite Plus® shall be glazed into the appropriate fire-rated frame(s) with an approved glazing compound (Silicone or Closed Cell PVC Tape) as supplied by the Installer.

5. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00 and ASTM E2010-01; NFPA 252 and NFPA 257; and UL 9, UL 10B, and UL 10C.

B. Fireglass20® as distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-425-396-8300, e-mail sales@fireglass.com, web site www.fireglass.com

1. Fireglass20® glazing sizes shall be as shown on the drawings:

2. Properties: All 20 minute fire rated glass designated on the drawings shall carry the following properties:

   a. Thickness: 1/4 inch.
   b. Weight: 3.0 lbs. / sq.ft.
   c. Approximate Visible Transmission: 89 percent.
   d. Approximate Visible Reflection: 8.0 percent.
   e. Fire-Rating: 20 minutes (WITHOUT HOSE STREAM TEST) – Refer to Contract Drawings.
   f. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II)

3. Labeling: Each piece of Fireglass20® shall be permanently labeled fireglass 20™ with the fireglass 20™ logo, UL logo and fire rating in sizes up to 6,396 sq. in.

4. Fire Rating: Fire rating listed & labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00; NFPA 252; & UL 9, UL 10B, & UL 10C.

C. Pyrostop® as manufactured by Pilkington Pyrostop® as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-425-396-8300, e-mail sales@fireglass.com, web site www.fireglass.com

1. Pyrostop® glazing sizes shall be as shown on the drawings.

2. Composition: Composed of multiple sheets of "Optiwhite" high visible light transmission glass laminated with an intumescent interlayer.

3. Properties: All fire rated ceramic glass designated on the drawings shall carry the following properties:

   a. Thickness: 3/4" (45 min.), 7/8" (60 min.), 1-7/16" (90 min.) & 2-1/8" (120 min.)
      1) For Exterior Use, Insulated Glass Unit: 1-5/16" (45 min.), 1-5/8" (60 min.), 2-1/8" or 2-3/8" (120 min.).
   b. Weight: Varies with thickness (approximate range 9 to 22 lbs./sq. ft.)
   c. Approximate Visible Transmission: Varies with thickness (approximate range 88 to 75 percent).
   d. Fire-Rating: Up to 2 hours – refer to Contract Drawings for ratings.
   e. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
   f. STC Rating: Up to 46 dB.
   g. Exterior Grade: PVB layer on exterior surface.

4. Labeling: Each piece of Pilkington Pyrostop® shall be permanently labeled with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite® label only for sizes that exceed the listing. Pilkington Pyrostop® shall be glazed into the appropriate fire-rated frame(s) with an approved glazing compound (Silicone or Closed Cell PVC Tape) as supplied by the Installer.

5. Fire Rating: 60 Minutes and Greater: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E 119 and UL 263.

2.02 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Compound for Fire-Rated Glazing Materials:

1. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.

2. Glazing Compound: DAP 33 putty.

3. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.

B. Available Products:

1. Dow Corning 795 - Dow Corning Corp.

2. Silglaze-II 2800 - General Electric Co.
3. Spectrem 2 - Tremco Inc.

C. Setting Blocks: Hardwood or calcium silicate; glass width by 4 inches by 3/16 inch thick.

D. Spacers:

1. FireLite Plus® & Fireglass20® - Setting Blocks: Neoprene, EPDM or hardwood; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

2. Pilkington Pyrostop® - Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.

E. Cleaners, Primers and Sealers: Type recommended by manufacturer of glass and gaskets.

2.03 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Minimum required face or edge clearances.
3. Observable edge damage or face imperfections.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.02 INSTALLATION

A. Verify, by measurements at the job site, all dimensions affecting this work.

B. Comply with FGMA or GANA (For Pyrostop) standards and instructions of manufacturers of glass, glazing, sealants and glazing compounds.

C. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

E. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

F. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.

G. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit. Glass shall be set without springing or forcing and carefully centered laterally and vertically so as to provide uniform clearance.

H. Place glazing tape on free perimeter of glazing in same manner described above.

I. For Fireglass20® Provide minimum edge clearance of >1/4 inch (+1/8 inch/-1/16 inch) and a minimum edge cover of <3/8 inch (+1/16 inch/-1/16 inch).

J. For Pilkington Pyrostop® provide minimum 3/16 inch edge clearance

K. Install removable stop and secure without displacement of tape. Prior to glazing, remove stops and clean out all dirt, oil, droppings, or other material, which will affect proper glazing.

L. Use specified glazing compound, without alteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.

M. Install in vision panels in fire-rated doors to requirements of NFPA 80.

N. Install so that appropriate UL and FireLite Plus®, Fireglass20® & Pilkington Pyrostop® markings remain permanently visible and upright.

3.03 PROTECTION AND CLEANING

A. Glass shall be suitably screened from paint, construction debris, and the like. All such soiling occurring on glass shall be promptly and completely washed off by methods approved by the glass manufacturer.

B. Upon completion of installation and acceptance, markings and labels of whatever sort shall be carefully and completely removed from glass panels and the glass washed clean with a mild neutral or slightly acidic solution as recommended by the glass manufacturer, after which no marking or labels of any sort shall be placed on the glass. Care shall be taken during cleaning to avoid scratching of glass surfaces by grit particles.

C. Ventilate buildings after glazing by opening windows slightly to prevent condensation on glass. Maintain ventilation until compound has set.

3.04 GUARANTEE

A. The Contractor shall guarantee all workmanship and material in accordance with the General Conditions and Section 017000 – Contract Closeout.

3.05 GLAZING SCHEDULE

Rating	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	**OR**	Max. Height Of Exposed Glazing (In.)	Stop Height
20 min.	Doors					
	HMS or Wood*	3,204	36		89	5/8”
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or Wood	3,325	95		95	5/8”
	Fireframes D.S.	3,325	95		95	3/4"

45 min.	Doors				
	HMS or Wood	3,204	36	89	5/8”
	Fireframes D.S.	3,204	36	89	3/4"
	Other than doors				
	HMS or Wood	3,325	95	95	5/8”
	Fireframes D.S.	3,325	95	95	3/4"
60 min.	Doors (non-temp rise)				
	HMS or Wood	3,204	36	89	5/8”
	Fireframes D.S.	3,204	36	89	3/4"
	Doors (temp rise)	100	12	33	5/8”
	Other than doors				
	HMS or Wood	3,325	95	95	5/8”
	Fireframes D.S.	3,325	95	95	3/4"
90 min.	Doors (non-temp rise)	2,034	36	56 ½”	3/4”
	Doors (temp rise)	100	12	33	1/2”
	Other than doors				
	HMS	2,627	56 ½”	56 ½”	5/8”
	Fireframes D.S.	2,627	56 ½”	56 ½”	3/4"
3 hours	Doors	100	12	33	1/2”

* HMS indicates hollow metal steel framing. Fireframes D.S. indicates Designer Series narrow profile framing. For wood frames, check with manufacturer for maximum tested glass sizes.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 090561.13 – WATER VAPOR EMISSION CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Work includes Moisture Vapor Emission (MVE) Control System to prepare surface of concrete to receive moisture sensitive adhesives and floor coverings. MVE Control System will protect finish flooring from moisture and pH Alkalinity.

1. Exterior rated, no moisture limit, trowel grade mortars to repair concrete prior to application of MVE Control coating.

2. Static and dynamic concrete crack repair materials.

3. Fluid-applied, resin-based, membrane-forming coating to control the moisture vapor emission rate (MVER) of interior suspended concrete slabs, slab on grade and light weight slabs.

4. Bond promoting primer for non-absorbent substrate to receive cementitious underlayments.

5. Self-leveling floor underlayment.

1.02 RELATED SECTIONS

A. Section 033000 – Cast-in-Place Concrete
B. Section 072600 – Vapor Retarders
C. Section 096466.11 – Wood Athletic Flooring (Conner “Duracushion III”)
D. Section 096466.12 – Wood Athletic Flooring (Conner “Rezill Channel”)
E. Section 096466.13 – Wood Athletic Flooring (Conner “Neo-Shok”)
F. Section 096519 – Resilient Tile Flooring
G. Section 096623 – Thin-Set Epoxy Terrazzo Flooring
H. Section 096800 - Carpeting

1.03 REFERENCES

A. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
B. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
C. ASTM 1907 – Standard Practices for Determining the Moisture-Related Acceptability of Concrete Floors to Receive Moisture- Sensitive Finishes
D. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials
E. ASTM 4541B – Pull-Off Strength of Coatings
F. ASTM C109 – Standard Test Method for the Compressive Strength of Hydraulic Cement Mortars.
G. ASTM C1708 – Standard Test Method for Self-Leveling Mortars Containing Hydraulic Cement
H. ASTM F2873 – Standard Practice for the Installation of Self-Leveling Underlayment and the Preparation of Surface to Receive Resilient Flooring.
I. ASTM D5125 - Standard Test Method for Viscosity of Paints and Related Materials by ISO Flow Cups.
J. ASTM E1155 – Standard Test Method for Determining FF (Floor Flatness) and FL (Floor Levelness)
K. ASTM F3010 – Standard practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation System for use Under Resilient Floor Covering

L. ACI 503.1R, ASTM C1583 – Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
M. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Tester.
N. ASTM C1583/ACI 503.1R - Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
O. ASTM 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
P. ICRI (International Concrete Repair Institute) Guide 310.2R- Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair
Q. RFCI - Recommended Work Practices for Removal of Resilient Floor Coverings, Resilient Floor Covering Institute
R. ACI 504 R-90 – Guide to Sealing Joints in Concrete Structures
S. ACI 302.1 – Guide for Concrete Floor Slab Construction
T. ACI 302.2 – Guide for Concrete Slabs that Receive Moisture- Sensitive Flooring Materials.
U. ASTM D1308 – Chemical Resistance of Finishes
V. United States Green Building Council (USGBC) LEED certification or other sustainability certification.
W. South Coast Air Quality Management District (SCAQMD) 1168
X. ASTM C856 Standard Practice for Petrographic Examination of Hardened Concrete

1.04 DEFINITIONS

A. MVE: Moisture Vapor Emission
B. MVER: Moisture Vapor Emission Rate (measured in lbs/1000 sf / 24 hours)
C. RH: Relative Humidity (measured in percentage)
D. VOC: Volatile Organic Compound (measured in g/L)
E. CSP: Concrete Surface Profile defined by ICRI

1.05 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Details of construction and relationship with adjacent construction. Indicate location of building movement joints.

D. LEED Design Submittals:

1. Product Data indicating VOC content of coatings.
2. Laboratory Test Results indicating compliance with low-emitting materials
3. Manufacturer’s product data indicating no urea-formaldehyde content.
4. Documentation showing test results measuring VOC content according to SQAQMD Rule No 1113.

E. Warranty:

1. MVE Control System Manufacturers 10 year Warranty
2. Installer of water vapor reduction system shall provide standard installation warranty for workmanship.

F. Qualification Data: Dates that Contractor's on-site personnel received training by the moisture vapor control system manufacturer.

G. Submit list of at least three similar projects performed by the Contractor within the previous three years that used the same products and similar moisture vapor control system and self-leveling underlayment.

H. Pre-Installation Moisture Vapor Test Reports

I. Field Quality Control Reports including Moisture Vapor Tests and Bond Strength Pull Tests on coatings and repair mortars.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened original packaging until ready for installation. Record product codes and batch numbers and shelf life.

B. Store products in a dry area with temperature maintained between 50 deg F (10 deg C) and 85 deg F (29 deg C) and protect from direct sunlight.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years manufacturing concrete resurfacing and rehabilitation products. Employs factory trained personnel who are available for product knowledge training.

B. Installer Qualifications: Minimum 5 years installing moisture vapor emission control systems.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until mockup is approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
4. Mockup will be basis for quality control evaluation on remainder of Work.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Comply with MVE control systems manufacturer's written instructions for substrate and ambient temperature, but not less than 50 deg F (10 deg C) and not more than 90 deg F (32 deg C) at least 48 hours before use.

B. Maintain ambient air temperature and relative humidity in installation areas within range recommended in writing by MVE control systems manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C) and not less than 40 or more than 60 percent air relative humidity for 48 hours before, during installation, and for 48 hours after installation, unless longer period is recommended in writing by manufacturer.

C. Install MVE control systems where concrete surface temperature will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

1.09 PRE-INSTALLATION CONFERENCE

A. Discuss Contract Document Requirements, moisture tests, manufacturer recommendations, installer's recommendations, scheduling, and protection of work from damage by other trades.

B. Attendance required by: Contractor, Floor Installer, Manufacturer's Representative, Independent testing agency, Concrete Subcontractor, Ready Mix supplier.

C. Objective of conference is:

1. Review methods and procedures
2. Tour job site representative areas to inspect and discuss condition of substrate
3. Review concrete finishing requirements
4. Review and finalize construction schedule
5. Review required inspections, testing, certifications, material usage procedures
6. Review environmental restrictions and forecasts
7. Record content of conference including attendance and topics.

D. Furnish record of pre-installation conference to all parties who are affected by MVE control systems work.

1.10 SCHEDULING

A. Before installation of VCT, sheet vinyl, rubber flooring, wood, carpet and/or epoxy flooring systems over the interior concrete slabs, anhydrous calcium chloride testing shall be performed per ASTM F 1869 or ASTM F 2170 by the Contractor to determine the level of water vapor transmission or relative humidity in the slab and the application rate of the moisture vapor reduction system required.

B. Coordinate the scheduling of the water vapor reduction system testing, allowing adequate time to test, review results and determine the water vapor reduction system application rate before installation of floor finish is required.

C. Allow a reasonable period of time (Minimum of 3 days) for the concrete slab to cure and dry before performing anhydrous calcium chloride tests. All mastics, glues, curing compounds and contaminants shall be removed to provide a clean, sound, concrete substrate prior to performing anhydrous calcium chloride tests.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: MAPEI Americas U.S.A., 1144 E. Newport Center Rd., Deerfield Beach, FL 33442; ASD. Toll Free Tel: 800-42-MAPEI; Tel: 954-246-8888; Fax: 954-246-8801; Email: TechServiceRequests@mapei.com; Web: www.mapei.us.

B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 013300.

2.02 MVE SYSTEM

A. Components of MVE Control System from single source manufacturer. Do not mix products from different manufacturers. Subject to compliance with requirements, provide the following:

1. Concrete Repair Mortar: Minimum compressive strength after 24 hours > 2700 psi and after

28 days > 4000psi when tested in accordance with ASTM C109 / C109M. Repair mortar to be exterior rated with no moisture limitations for use to repair concrete prior to application of MVE control system. Basis of Design: MAPEI *Mapecem® Quickpatch* with *Planicrete® UA* additive.

2. Crack Repair Resin for static non-moving joints: Basis of Design: MAPEI *Epojet™ LV* or MAPEI *Planibond® EBA*. Thickening with sand is acceptable.

3. Crack Repair for dynamic movement joints: Basis of Design: MAPEI *Mapeflex™ P1 SL* one-Component, Self-Leveling Elastomeric Polyurethane Sealant

4. MVE Control Epoxy Coating component of the MVE Control System: ASTM F3010 qualified, fluid-applied, two component, 100% solids epoxy resin, low viscosity, penetrating, one-coat membrane forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor covering indicated, including adhesives. Basis of Design: MAPEI *Planiseal® VS*.

    a. Performance for MVER ASTM F1869: up to 25 lbs per 1000 square feet (9.07 kg per 92.9 m²) per 24 hours.

    b. Performance for Relative Humidity ASTM F2170: up to 100% RH

    c. VOC Content SCAQMD Rule No 1113: < 50 g/L

    d. Viscosity: < 250 cps

    e. Pull Off / Bond Strength / Concrete Adhesion ASTM D7234: > 1000 psi (6.90 mPa) at 28 days with failure in concrete substrate

    f. Permeability ASTM E96: ≤ 0.1 perm at ≥ 10 mil Dry Film Thickness

    g. Reduction of Moisture Vapor Transmission ASTM E96: > 96% at 10 mil DFT

    h. Alkali Resistance ASTM D1308: No affect up to pH 14 at 14 days

    i. Relative Humidity Resistance ASTM 2170: Resists up to 100% RH.

5. Bond Promoting Primer over non-absorbent MVE Control Epoxy Coating to receive up to 3/8 inch thickness of Self-Leveling Underlayment: Basis of Design: MAPEI *Primer T™*

6. Bond Promoting Primer over non-absorbent MVE Control Epoxy Coating to receive over 3/8 inch thickness of Self-Leveling Underlayment: Basis of Design: MAPEI *Primer E™* with sand broadcast. Consult Manufacturer.

7. Self-Leveling Underlayment to be shrinkage compensated to smooth and flatten floors while creating a blotter layer. Blotter layer, an absorptive layer required for water-based floor covering adhesives used to install finish floors. Minimum compressive strength after 24 hours > 2000 psi, and after 28 days > 4100 psi when tested in accordance with ASTM C109 / C109M. Basis of Design: MAPEI *Ultraplan® 1 Plus*.

8. Final skim coat as needed prior to installing floor finish: MAPEI *Planiprep™ SC*.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Allow at least 7 days after placement of concrete to begin this Work.

B. Examine substrates and conditions for compliance with requirements for maximum moisture RH content ASTM F2170, and/or MVE ASTM F1869 per the floor covering manufacturer.

C. Verify slab has not been contaminated.

D. Perform water bead test and photographically record contact angle of water bead meniscus to the floor to ensure concrete is hydrophilic.

E. Record alkalinity testing per ASTM F710.

F. Record ambient air RH, dew point and temperature.

G. Record slab temperature.

H. Concrete substrates must be structurally sound, solid, and meet industry standards as defined in ACI Committee 201 Report “Guide to Durable Concrete”.

I. Notify Architect of out of tolerance conditions that will affect Work. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of moisture control system indicates acceptance of surfaces and conditions.

3.02 PREPARATION TESTING

A. Pre-installation Testing by independent Testing Agency: Contractor shall engage a qualified testing agency to perform tests. Testing performed by an ICRI Concrete Moisture Testing Technician – Grade 1.

B. Alkalinity Testing: Perform pH testing according to ASTM F710. Install MVE control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 9.0.

C. Moisture testing: Conform to ICRI test standards for three tests in the first 1000 sq ft and one test per 1000 sq ft after that. Perform no fewer than three tests in each installation area and with tests evenly spaced in installation to best represent the widest range of conditions.

1. Perform Anhydrous Calcium Chloride Test: ASTM F1869. Install MVE Control system in locations where concrete substrate MVER exceeds three lbs of water / 1000 sq ft / 24 hours.

2. Perform Internal Relative Humidity Testing: ASTM D2170. Install MVE Control System in locations where concrete substrate RH exceeds 85%.

D. Bond Testing: Install minimum 100 sq ft (9.29 sq m) test area of complete assembly of MVE Control System bonded to prepared concrete substrate. Proceed with installation if tensile bond strength on MVE Control System is greater than 200 psi (1.38MPa) in heavy commercial traffic and 150 psi for normal foot traffic when tested in accordance with ASTM C1583.

E. Concrete Core Test

1. X Ray Diffraction (XRD) analysis which includes the evaluation of the concrete solids via energy dispersive x-ray analysis (EDXA) 0-4 mm BTC Profile – (Below Top of Core Surface)

2. Infra-red (IR) spectroscopy which is the organic chemical analysis, 0-4 mm BTC profile

3. Ion Chromatography (IC) analysis which is the analysis of water-soluble CL, SO4, K & Na 0-4 mm BTC Profile.

3.03 SURFACE PREPARATION

A. Clean and prepare concrete substrate according to MVE control system manufacturer's written instructions to ensure adhesion of systems to concrete.

B. For direct application of epoxy MVE control coating without mechanical profiling, concrete must be porous, have a CSP of #2 to #3, and be in pristine condition with no contamination present.

C. Mechanically remove coatings and other substances that are incompatible with MVE control systems and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE control systems Manufacturer. Do not use solvents. Do not acid etch. Mechanically remove troweled CSP 1 finish. Concrete surface must be mechanically profiled using dustless, engineer-approved methods to obtain a CSP of #2 to #3.

   1. Method One: Achieve ICRI 310.2R Minimum CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus and recirculates the shot by vacuum pickup. Shot-blast with spherical steel shot SAE size range 230 – 300 as necessary to produce the required profile. Remove all residual shot with a magnet. Use a handheld grinder to CSP 2 only in areas that cannot be reached with bead blasting.

   2. Method Two: Achieve ICRI 310.2R Minimum CSP 2 by diamond grinding that abrades the concrete surface. Remove all dust by vacuuming with high-efficiency particulate arrestance (HEPA) filter.

D. Excessively weak, soft, dusty, cracked, or uneven surfaces may not be suitable substrates and may require additional concrete removal techniques such as scarification and then patching prior to application of the MVE Control System.

E. Asbestos abated slabs may have hydrophobic organic compounds in the capillaries of the concrete which will be a bond break for coatings. Microscopic petrographic examination according to ASTM C856 to evaluate the concrete condition, potential deleterious substances and suitability for shot-blasting and coating adhesion.

F. Reinforcing fibers that become visible after shot blasting must be removed and vacuumed leaving no fibers exposed above the concrete surfaces.

G. Do not install MVE Control System if substrate testing reveals unacceptable conditions.

H. Ensure that all old adhesives, contaminants, curing compounds, oils, silicates, dust and other bond breakers are completely removed.

I. Remove dust and debris by broom sweeping and then vacuuming with high-efficiency particulate arrestance (HEPA) filter. Do not use sweeping compound as they contain oils and wax that would contaminate the concrete surface and inhibit bond of MVE Control System.

J. After shot blasting, repair damaged and deteriorated concrete according to MVE control system manufacturer's written instructions.

K. Prior to application of MVE Control Epoxy Coating, fill substrate surface depressions, ruts, spalls and other irregularities with exterior grade patch: MAPEI *Mapecem*® *Quickpatch* with *Planicrete*® *UA* additive.

L. Do not skimcoat entire concrete slab prior to application of epoxy MVE control system.

M. Allow concrete to off-gas after bead blasting for a minimum of 24 hours but no more than 48 hours to avoid contamination by other trades. Failure to wait may result in the epoxy coatings ability to

perform as a MVE control due to pin-holing, blisters and fish-eyes.

3.04 CRACK PREPARATION

A. Consult with an experienced engineer to determine the appropriate substrate repair procedures and joint treatment methods. Engineer to address contraction as well as potential expansion, movement and isolation joints. Cracks or de-bonding in the MVE control system that results from substrate movement are not required to be warranted.

B. Record location of cracks, both static and dynamic, on shop drawings.

C. Do not apply MVE control system across substrate expansion, isolation, and other dynamic moving joints.

D. Mechanically prepare non-moving control and construction joints with a diamond crack-chasing/concrete-cutting blade. Overcut joint width to obtain a sound, clean edge. Clean cracks or joints with oil-free compressed air and dustless high-efficiency particulate arrestance (HEPA) filter vacuum to completely remove contaminants (follow ACI RAP Bulletin 2, “Crack Repair by Gravity Feed with Resin”).

E. Pre-filling static thin random drying shrinkage cracks (less than 0.01 inch (0.25 mm) width and not vertically displaced) is not required. Apply MAPEI *Planiseal® VS* normally over areas of thin shrinkage cracked concrete.

F. Fill static cracks (narrower than 1/8 inch (3 mm) and not vertically displaced) with MVE Crack Repair Resin. Prefill cracks with 20 to 30 sieve size clean washed kiln dried sand and apply *Epojet™ LV*.

G. Fill static cracks (wider than 1/8 inch (3 mm) and not vertically displaced) with high-modulus epoxy MAPEI’s *Planibond® EBA*; thickened with sand to create an epoxy mortar.

H. Should contraction, control or saw-cut joint dormant joints appear not filled flush to top of surface after installation of MVE Crack Repair Resin, fill static non-moving joints with high-modulus MAPEI *Planibond® EBA* epoxy. Fill joints full-depth and flush to surface.

I. Fill dynamic joints with self-leveling polyurethane sealant MAPEI *Mapeflex™ P1 SL*. Do not span movement joint with self-leveling underlayment nor flooring.

J. Reinforcing fibers that become visible after crack preparation must be removed and vacuumed leaving no fibers exposed above the concrete surface.

3.05 PROTECTION

A. Protect walls, floor openings, electrical openings, door frames, and other obstructions during the installation.

3.06 INSTALLATION MVE CONTROL SYSTEM - EPOXY

A. General: Install MVE control system according to ASTM F3010 and manufacturer’s written instructions to product a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes and voids.

B. Adjust application methods per manufacturer’s written instruction as determined by site conditions, presence of sub-slab vapor barrier, concrete mix design, lightweight aggregates, suspended slab vs slab on grade, and age of concrete.

C. Refer to the Safety Data Sheet (SDS) for details on handling and safety equipment.

D. Mixing: Mix in accordance with Manufacturer's instructions. Mix only full units. Strictly follow minimum mixing time.

E. In a single coat application, apply MVE control system epoxy to manufacturer's recommended rate with no less than dry film thickness of 10 mils minimum to achieve design perm rating. Apply with notched squeegee or notched trowel and back roll with 3/8 nap roller. Adjust application rate depending on job site concrete conditions including porosity and profile.

F. Cure MVE Control System components according to the manufacturer's written instruction. Prevent contamination or other damage during curing processes.

G. After curing, examine MVE control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

3.07 FIELD QUALITY CONTROL

A. Inspect MVE Control System to ensure that all voids and pinholes are filled/sealed before moving on to the next flooring phase. Do so by filling any voids and/or shaving off the tops of any bubbles and reapplying a thin coating of MVE Control System over the surface. Verify no bond break present.

3.08 INSTALLATION OF PRIMER FOR SELF-LEVELER

A. Self-Leveling Underlayment up to 3/8 inch thickness: Apply Primer T™ to epoxy MVE control system and allow primer to dry completely.

B. Self-Leveling Underlayment over 3/8 inch thickness: Apply Primer E™ to epoxy MVE control system and broadcast 20/30 sieve clean washed kiln dried sand to rejection. After 24 hours, vacuum non-bonded sand.

3.09 INSTALLATION OF SELF-LEVELING UNDERLAYMENT

A. Read all installation instructions thoroughly before installation.

B. Before installation, close doors and windows, and turn off HVAC systems to prevent drafts during application and until the floor cures. Protect areas from direct sunlight.

C. Make sure concrete substrate and ambient room temperatures are between 50°F and 95°F (10°C and 35°C) before application. In large applications, allow for indirect air circulation to dissipate humidity created by leveler application. Temperatures must be maintained within this range for at least 72 hours after the installation of self-leveler. In cooler conditions, use indirect auxiliary heaters to maintain ambient and substrate temperatures within the required range. For temperatures above 85°F (29°C), follow ACI hot-weather application guidelines to ensure a successful installation.

D. Water to be clean, potable, and cool, not warmer than 70 deg F.

E. Conventional piston, rotor-stator or underlayment-type pumps may be used for application of self-leveling over large areas.

F. Strictly follow manufacturer's mixing instructions for exact water cement ratios, mixing times, speed and type of mixing blade. Mix full unit quantities, if working from bulk containers (ie super sacks), mixer must be able to accommodate entire unit of unmixed product. Self-leveler is a calcium aluminate quick setting, fast drying shrinkage compensated product when mixed correctly. Overwatering will cause shrinkage and potential delamination.

G. Maintain continuous flow of wet material to avoid trapping air or creating a cold joint.

H. Maintaining a wet edge throughout placement. Quickly pour or pump self-leveler onto properly prepared and primed surface in ribbon pattern.

I. Spread self-leveler with gauge rake to desired depth. Break surface tension of material with smoother or needle roller to allow self-leveler to flow. Apply at 3/16 inch minimum thickness.

J. Apply self-leveler to flatness of 1/8 inch in 10 feet.

K. Verify with Manufacturer regarding minimum time to install ceramic tile, or non-breathable floor coverings on self-leveler.

3.10 CLEANUP

A. Use soap with water or use denatured alcohol to clean equipment before MVE Control System cures to a hardened state. Cured material can only be removed mechanically.

3.11 PROTECTION – MVE CONTROL SYSTEM

A. Protect the surface of the cured MVE control system from traffic and damage until covered by floor finish. Protection may include plywood, or other suitable protection board

END OF SECTION

DIVISION 09 – FINISHES

SECTION 092300 – GYPSUM PLASTER

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Gypsum and metal lath bases for the support of gypsum plaster used as a finish for partitions and ceilings where indicated on the drawings and as specified herein.

B. Accessories, Cornerite™, corner beads, and casing beads as required.

C. Drawings and General Provisions of the Contract, including General Conditions and Supplementary Conditions and Division 01 specification section, apply to work of this section.

1.02 RELATED WORK UNDER OTHER SECTIONS

A. Section 042000 – Unit Masonry
B. Section 054000 – Cold Formed Metal Framing
C. Section 061000 – Rough Carpentry
D. Section 079200 – Joint Sealants
E. Section 092900 – Gypsum Wall Board
F. Section 099000 – Painting

1.03 SUBMISSIONS

A. Submit to the Architect for approval samples as described in General and Supplementary Conditions and do no work and order no materials prior to written approval. Installed work must conform exactly to approved samples.

B. Product Data: Manufacturers' specifications and installation instructions for each product specified.

C. Shop Drawings: Show layout of control joints.

D. To avoid unnecessary samples, only those described below will be requested. However, as part of the Contract, when requested by the Architect, additional samples are to be promptly submitted.

E. Identify completely all samples. Describe material, gauge, size, treatment, texture, finish, where to be used, and color or colors when applicable. Include names of project, Architect, Contractor, vendor, and manufacturer.

F. Submit in duplicate:

1. Sample panels (each finish): 12" x 12".

1.04 APPLICABLE STANDARDS

A. American Society for Testing and Materials (ASTM):

B. A 641, Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
C. C 28, Specification for Gypsum Plasters.
D. C 35, Specification for Inorganic Aggregates for Use in Gypsum Plaster.
E. C 37, Specification for Gypsum Lath.
F. C 59, Specification for Gypsum Casting and Molding Plaster.

G. C 841, Specification for Installation of Interior Lathing and Furring.
H. C 842, Specification for Application of Interior Gypsum Plaster.
I. C 847, Specification for Metal Lath.
J. C 954, Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.33 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
K. C 587, Specification for Gypsum Veneer Plaster.
L. C 1002, Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
M. C 1396, Specification for Gypsum Board (Gypsum Base for Veneer Plaster).

1.05 QUALITY ASSURANCE

A. Mock-Ups:

1. Lath and plaster an actual wall surface for each finish specified to show color, texture, and workmanship. Provide mock-ups of at least 100 sq. ft. Obtain the Architect's approval of mock-up locations.

2. Simulate finished lighting conditions for the Architect's review of mock-up.

3. Do not start plastering until mock-up is approved by the Architect. Provide additional mock-ups if necessary to obtain approval. Do not alter mock-ups until plastering is completed.

1.06 DELIVERY, QUALITY ASSURANCE

A. Packaging and Shipping: Have materials shipped in manufacturer's original packages showing manufacturer's name and product brand name.

B. Storage and Protection: Store materials inside and protected from damage by the elements. Protect ends, edges, and faces of gypsum lath from damage. Protect metal framing and accessories from bending.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Comply with ASTM C 842.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Gold Bond Building Products, LLC provided by National Gypsum Company.

1. Gypsum Lath:

a. Regular: Gold Bond® Kal-Kore® Plaster Base.

2. Gypsum Plaster:

a. Base Plaster: Gold Bond® Gypsolite® Plaster.
b. Finish Plaster: Gold Bond® Kal-Kote® Smooth Finish Plaster.

2.02 MATERIALS

A. Metal Framing:

1. Studs: See Section 054000.

2. Main Runner Channels: 2 in. cold rolled steel channel, weighing 590 lbs. per 1000 lin. ft. with min. base steel of 0.054 in., galvanized or painted.

3. Main Runner Channels: 1-1/2 in. cold rolled steel channel, weighing 475 lbs. per 1000 lin. ft. with min. base steel of 0.054 in., galvanized or painted.

4. Cross Furring Channels: 3/4 in. cold rolled steel channel, weighing 300 lbs. per 1000 lin. ft. with min. base steel of 0.054 in., galvanized or painted.

5. Channel Studs: 3/4 in. cold rolled steel channel, weighing 300 lbs. per 1000 lin. ft. with min. base steel of 0.054 in., galvanized or painted.

6. Floor and Ceiling Runner: L shaped runner, weighing 545 lbs. per 1000 lin. ft. with min. base steel of 0.0329 in., galvanized.

B. Wood Framing: See Section 061000.

C. Metal Lath:

1. Diamond Mesh Lath: Expanded metal lath with 5/16 in. wide diamonds, weighing 2.5 lbs. and 3.4 lbs. per sq. yd., galvanized or painted steel, and complying with ASTM C 847.

2. Self-Furring Lath: Expanded metal lath with 5/16 in. wide diamonds, weighing 2.5 lbs. and 3.4 lbs. per sq. yd., with self-furring dimples to hold the lath 1/4 in. away from the substrate, galvanized or painted steel, and complying with ASTM C 847.

3. Rib Lath: Expanded metal with 1/8 in. deep solid metal ribs at 1-1/2 in. o.c., weighing 2.75 lbs. and 3.4 lbs. per sq. yd., galvanized or painted steel, and complying with ASTM C 847.

4. Rib Lath: Expanded metal with opposed, U shaped, 3/8 in. deep, solid metal ribs at 1-15/16 in. o.c.; weighing 3.4 lbs. per sq. yd.; galvanized or painted steel; and complying with ASTM C 847.

D. Gypsum Lath:

1. Regular: A gypsum core lathing panel surfaced with absorptive paper on front, back, and long edges and complying with ASTM C 1396 (Gold Bond® Kal-Kore® Plaster Base).

    a. Thickness: 1/2 in.
    b. Width: 4 ft.
    c. Length: 8 ft. through 16 ft.
    d. Edges: Square or Tapered.

2. Fire-Rated: A gypsum core lathing panel with additives to enhance the fire resistance of the core and surfaced with absorptive paper on front, back, and long edges and complying with ASTM C 1396, Type X.

    a. Thickness: 1/2 in. (Gold Bond® Kal-Kore® Fire-Shield C™ 1/2” Plaster Base) or 5/8 in. (Gold Bond® Kal-Kore® Fire-Shield® and Gold Bond® Kal-Kore® Fire-Shield C™ 5/8” Plaster Base).
    b. Width: 4 ft.
    c. Length: 8 ft. through 16 ft.
    d. Edges: Square or Tapered.

E. Gypsum Plaster:

1. Base Plaster: Gypsum plaster with mill-mixed perlite aggregate complying with ASTM C 28 (Gold Bond® Gypsolite® Plaster).

2. Finish Plaster: Gypsum plaster for smooth finish complying with ASTM C 587 (Gold Bond® Kal-Kote® Smooth Finish Plaster).

F. Sand: ASTM C 35.

G. Water: Potable.

2.03 ACCESSORIES

A. Corner Bead: Formed steel nose with 2-1/2 in. expanded metal flanges, weighing 200 lbs. per 1000 lin. ft. with min. base steel of 0.0179 in., galvanized.

B. Corner Bead: Formed steel nose with 3/4 in. radius and 2-1/2 in. expanded metal flanges, weighing 350 lbs. per 1000 lin. ft., galvanized.

C. Corner Bead: Formed steel nose with 3-3/16 in. reinforced expanded metal flanges, weighing 241 lbs. per 1000 lin. ft.

D. Casing Bead: J shaped zinc bead with expanded metal flange for 1/2 in. and 3/4 in. grounds, weighing 200 lbs. and 220 lbs. per 1000 lin. ft.

E. Expansion Joints: W shaped zinc joint with splayed expanded metal flanges for 1/2 in., 3/4 in. and 7/8 in. grounds, weighing 232 lbs. and 285 lbs. per 1000 lin. ft., galvanized.

F. Expansion Joints: Two piece formed zinc joint with slipped connection for 1/2 in., 3/4 in. and 7/8 in. grounds, galvanized.

G. Beam Furring Clip: Spring steel wire clip to fit beam flanges from 1/4 in. to 1 in. thick.

H. Tie Wire: Manufacturer's standard soft, annealed steel protected by Class 1 zinc coating and manufactured in accordance with ASTM A 641.

I. Fasteners:

1. Nails: As recommended by the manufacturer.

2. Screws: ASTM C 954 or ASTM C 1002 or both with heads, threads, points, and finish as recommended by the manufacturer.

2.04 MIXES

A. Proportions and Procedures: In accordance with ASTM C 842 and the manufacturer's recommendations.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. Examine all surfaces to be plastered before starting any work and ascertain any discrepancy or conditions that may affect or prevent production of a satisfactory job in plastering.

3.02 INSTALLATION

A. In accordance with the following ASTM Standards and manufacturer's recommendations:

1. ASTM Standards:

a. Metal Lath, Gypsum Lath, and Accessories: C 841.

b. Gypsum Plaster: C 842.

B. Tolerances: For flatness of surface, do not exceed 1/4 in. in 8 ft. for bow or warp of surface and for plumb and level.

C. Number of Coats: Apply gypsum plaster, of composition indicated, to comply with the following requirements:

1. Use three-coat work over the following plaster bases:

a. Metal Lath

2. Use two-coat work over the following bases.

a. Unit Masonry

D. Finish Coats: Apply finish coats to comply with the following requirements:

1. Troweled finish for gypsum finish coat plasters, unless otherwise indicated.

E. Cornerbeads: Furnish and install corner beads on horizontal and vertical external corners in plastered surfaces.

1. Install corner beads 12 feet and under in length in one piece. Set plumb or level as required flush with finished plaster and fasten securely along each wing at intervals at 6 inches in a manner not dependent on the plastering.

F. Casing Beads: Furnish and install casing beads as required and as follows:

1. Install at terminations of plasterwork, except were plaster passes behind and is concealed by other work and where metal screeds, bases or frames act as casing beads.

2. Install casing beads 10 feet and under in length in one piece. Set plumb or level as required flush with finished plaster and fasten securely at intervals of 6" in a manner not dependent on the plastering.

G. Control Joints: Install control joints as locations indicated on Drawings, with spacing between joints in either direction not exceeding the following and in specific locations approved by the Architect for visual purposes:

1. Partitions: 30 feet

2. Ceilings: 30 feet

H. Plastering:

1. Surfaces to receive plaster shall be clean and free from loose material and all foreign or objectionable matter. The installation of any plaster will be construed as acceptance of the

surfaces or work to receive plaster, and the Contractor shall be responsible for any subsequent discoloration of plaster by rust or cleaning or plaster from contiguous work that may be required. The Contractor shall therefore ensure the protection of all fixtures, frames, inserts, and other metal against rust or soiling as the result of plastering operations.

2. Plaster work shall be installed in a two (2) coat application: brown coat and finish coat for an overall ½" to 5/8" thick plaster coat or a three (3) coat application: scratch coat, brown coat, and finish coat for an overall 5/8" thick plaster coat. The specified finish coat shall be laid out so as to permit the completion of an entire panel in one operation to avoid unsightly jointing. Particular attention shall be given to the curing requirements described in the referenced standards.

3. All internal vertical and horizontal masonry corners to be plastered including connections to the existing plaster surfaces shall be continuously reinforced with corner lath. All external corners shall be protected with corner beads. Continuous strip lath shall be installed at the junction of dissimilar materials to be plasters. Reinforce corners of openings in block walls with diagonal strip lath.

3.03 PROTECTION, CLEANING, AND PATCHING

A. Protect fixtures, frames, inserts, and other metal against rust or soiling as the result of plastering operations. Provide temporary closures for openings in rooms to be plastered.

B. Protect plaster against freezing, premature drying, damage, marking, marring, or other defacing. Avoid soiling or spattering plaster on other parts of the building construction. Plaster on surfaces which are not required to be plastered shall be removed. Clean floors of plaster and debris, and leave broom clean.

C. Cutting, patching, repairing, and pointing up due to construction operations shall be thoroughly and neatly performed. Cutting, reinforcing and fitting around outlets, piping fittings, conduit, ducts, and other items extending through furred and lathed surfaces shall be provided as required. Cracks and indentations in plastered surfaces shall be thoroughly raked out or cut out, the surfaces around fixtures, outlet boxes, switch plates, fitting, piping, tile, and other materials or appliances abutting or extending into plaster shall be pointed-up and finished flush with the adjacent plaster. Where plaster shall be beveled to a plane so that the joint assumes approximately a 45-degree angle.

3.04 GUARANTEE

A. Work showing any defects within the guarantee period covered by Contract Documents shall be corrected as directed by the Architect. These shall include, but are not limited to, the following:

1. Cracking.

2. Discoloration.

3. Dusting, disintegration, or defective adhesion to masonry or undercoats.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 092900 – GYPSUM WALLBOARD

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work of this section is subject to all applicable provisions of the "General Conditions" and "Division 01 - General Requirements" which form part of this specification.

B. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

1. Light gauge interior metal drywall studs for partitions and bulkhead framing.
2. Gypsum wallboard as specified, anchorages and control joints.
3. All trim, battens, corners, and similar items.
4. All required fastenings, framing, and attachments.
5. All adhesive, tapes, and joint compound systems as required.
6. Wall to wall corner expansion joints.
7. Metal drywall ceiling framing, furring and accessories.
8. Acoustical insulation and sealants.

C. Products installed but furnished under other sections and trades:

1. Metal drywall suspended ceiling grid system.
2. Metal wall/ceiling access panels furnished by other trades, as appropriate to project.
3. Metal lighting fixture plaster frames and rings, etc., within gypsum board ceiling system.
4. Cementitious backer units: Section 093013 – Porcelain and Glazed Ceramic Tile.

1.02 RELATED WORK

A. Related work specified under other sections of the specifications:

1. Section 054000 – Cold Metal Framing
2. Section 061000 – Rough Carpentry
3. Section 079200 – Joint Sealants
4. Section 081113 – Hollow Metal Doors and Frames
5. Section 081416 – Flush Wood Doors
6. Section 093013 – Porcelain and Glazed Ceramic Tile: for cementitious backer units.
7. Section 099000 – Painting
8. Section 265100 – Interior Lighting: ceiling lighting fixtures with plaster frames and/or rings for recessing fixtures in gypsum board ceiling systems.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM A525 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
2. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. ASTM A645 – Standard for Nonstructural Framing Members.
4. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated, (Galvanized) by the Hot-Dipped Process.
5. ASTM C442 – Standard Specification for Gypsum Backing Board, Gypsum Coreboard and Gypsum Shaftliner Board.
6. ASTM C473 – Standard Test Methods for Physical Testing of Gypsum Panel Products.
7. ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
8. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
9. ASTM C635 – Standard Specifications for Metal Suspension Systems.
10. ASTM C636 – Recommended Practice for Installation of Metal Suspension Systems.
11. ASTM C645 – Standard Specification for Non-Bearing (Axial) Steel Studs, Runners, (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
12. ASTM C665 – Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
13. ASTM C754 – Specification for Installation of Steel framing Members to Receive Screw-Attach Gypsum Boards.
14. ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board.
15. ASTM C955 – Standard Specification for Cold-Formed Steel Structural Framing Members.
16. ASTM C1002 – Steel Drill Screws for the Application of Gypsum Board.
17. ASTM C1047 – Accessories for Gypsum Wallboard and Gypsum Veneer Base.
18. ASTM C1178 – Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
19. ASTM C1278 – Standard Specification for Fiber-Reinforced Gypsum Panels.
20. ASTM C1396 – Standard Specification for Gypsum Board.
21. ASTM C1629, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
22. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
23. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
24. ASTM E136 – Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750º C.
25. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
26. ASTM F1267 – Specification for Metal, Expanded, Steel.

B. Gypsum Association (GA):

1. GA-214 – Recommended Levels of Gypsum Board Finish.
2. GA-216 – Recommended Specifications for the Application and Finishing of Gypsum Board.
3. GA-600 – Fire Resistance and Sound Control Design Manual.
4. GA-801 – Handling and Storage of Gypsum Panel Products.

C. Underwriters Laboratory, Inc. (UL):

1. UL US-22 – Wallboard, Gypsum.
2. UL 40-U18 – Fire Resistance Classification.

D. Steel Structures Painting Council (SSPC):

1. SSPC – Painting Manual.

1.04 QUALITY ASSURANCE

A. To assure compatibility, studs, runner track, clips, etc. shall be the product of the same manufacturer.

B. Comply with the minimum requirements of the following except where more stringent requirements are specified herein. All gypsum wallboard shall be asbestos free.

1. Gypsum Wallboard: ASTM C-1396.
2. Joint Treatment: ASTM C-475.
3. Non-load bearing steel studs, runners, and rigid furring channels for screw attachment of gypsum wallboard: ASTM C-645.

C. Perform work in accordance with ASTM C754, ASTM C840 and GA-216.

D. Maintain copies of GA-216 documents on site.

E. When fire-resistive construction is detailed or noted on the Contract Drawings, perform work in accordance with GA-600.

1.05 QUALIFICATIONS

A. Erector Qualifications: Company specializing in the erection of metal stud framing and gypsum wallboard systems on at least three (3) acceptable projects equal in scope to work specified.

1.06 SUBMITTALS

A. Shop Drawings, Product Data and Samples: Shall be submitted in accordance with Division 01.

B. Shop Drawings: Indicate all special details associated with fireproofing, acoustical seals, and ceiling and bulkhead framing.

C. Product Data: Provide manufacturer’s descriptive literature on metal framing, gypsum board, joint tape, and installation instructions and procedures.

D. Manufacturer’s verification that gypsum wallboard contains 100% post-consumer and post-industrial recycled content.

E. Manufacturer’s verification that VOC content of interior sealants is less than 250 g/L.

F. Manufacturer’s verification that VOC content of gypsum wallboard adhesive is less than 50 g/L.

G. Manufacturer’s verification that steel studs and framing contain at least 35% combined post-consumer and post-industrial recycled content.

H. Samples:

1. Submit samples for the Architect's approval in accordance with the applicable provisions of the contract documents.

2. Submit three (3) samples of each of the following:

a. Gypsum wallboard: 12" by 12" each type and finish.

b. Trim: 6" lengths of each type and finish.

c. Compound: 1 pint cans.

d. Tape: 12" lengths.

e. Screws and fastenings: Each size and type.

f. Submit shop drawings and engineering calculations for special areas as requested by the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions, GA-216 and GA-801. Stack product flat on a level surface. As individual sheets are removed for installation, raise products carefully on edge and carry in a vertical position. Take care to avoid impact, undue flexing and damage to edges, ends and corners.

B. Deliver all materials in unopened, original containers bearing manufacturer's labels. Store materials in a clean, dry, protected place and do not leave exposed to weather. Handle all materials with proper care to prevent damage. Handle and protect all materials and metal accessories from damage, dampness or wetting.

C. Remove all items delivered in broken, damaged, rusted or unlabeled condition from site immediately.

D. Storage:

1. Store all materials inside under cover, providing protection from damage and exposure to the elements, stacked flat, and off-floor.

2. Stack wallboard so that lengths are not over short lengths, avoid overloading floor system.

3. Store adhesives and ready-mixed joint compound in dry area; provide protection against freezing at all times.

4. Damaged, frozen, and deteriorated materials shall be removed from the job site.

1.08 JOB CONDITIONS

A. Environmental Conditions:

1. Temperature: During cold weather, in areas receiving wallboard installation and joint finishing, maintain temperature range between 55° to 70° F for one week prior to attachment or joint treatment, and until joint treatment is complete and dry.

2. Do not install gypsum board when ambient temperature is below 40°F.

B. Ventilation:

1. Provide adequate ventilation to carry off excess moisture during and following adhesive and joint compound treatment applications.

2. Use temporary air circulators in enclosed areas lacking natural ventilation. Under slow drying conditions, allow additional drying time between coats of joint treatment.

3. Protect installed materials from drafts during hot, dry weather.

4. Protection: Protect adjacent surfaces against damage and stains.

1.09 COORDINATION WITH OTHER WORK

A. General:

1. Coordinate with other work including mechanical and electrical work and partition systems. Installation of conduit and ductwork above suspension system shall be complete before installation of suspension system.

B. Protection:

1. Follow good safety and industrial hygiene practices during handling and installation of all products and systems, with personnel to take necessary precautions and wear appropriate personal protective equipment as needed. Read Material Safety Data Sheets and related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issues during and subsequent to installation; architect, specifier, owner and manufacturer will rely on contractor's performance in such regard.

PART 2 - PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Provide metal wall and bulkhead framing materials in accordance with GA 216.

B. Metal Studs - Drywall Type: ASTM C645: non-load bearing, galvanized sheet steel, ASTM A525; Cee-shaped, size as indicated on the drawings or noted below, conforming to the following:

1. Rated/non-rated, non-bearing metal stud partitions with single/double layer drywall: 20 gauge (up to 11 feet-6 inches in height; 18 gauge over 11'-6" in height.

2. Rated/non-rated, load bearing metal stud partition with single/double layer drywall: 20 gauge.

3. Ceiling and Wall Furring Channels: 1-3/8" face x 7/8" deep as manufactured by USG Corporation or approved equal. "Z" furring channels, 26 gauge hot dipped galvanized, 1-1/2" deep as manufactured by USG Corporation or approved equal.

4. Metal stud partitions with gypsum board/tile backerboard and ceramic tile finish: 20 gauge or heavier.

5. Metal stud framing at hollow metal door and light openings: 20 gauge.

6. Metal studs for infill framing at renovation/alteration areas: 25 gauge. Runners: Of same material and thickness as studs, bent leg retainer notched to receive studs.

C. Ceiling Runner: Where required, provide with extended leg retainer. Furring, Bridging and Bracing: Of same material as studs; thickness to suit purpose. Sheet Metal Backing: 20 gauge thickness, galvanized steel.

D. Fasteners: GA-216.

E. Touch-Up Primer for Galvanized Surfaces: SSPC SP 20, zinc rich.

F. Anchorage to Substrate: Tie wire, screws, nails and other metal supports, of type and size to suit application; to rigidly secure materials in place.

2.02 CEILING FRAMING

A. Channels: Fabricated of 16 gauge (1.5 mm) cold-rolled steel, factory applied black asphaltum rust-resistant paint. Minimum weight per 1,000 lineal feet:

1. Depth: 2 inches, 590 lbs.

2. Depth: 1 1/2-inches, 300 lbs.

B. Furring Channels: Screw-type, hat-shaped, 25 gauge (0.5 mm)

C. Optional Framing: Metal stud, ASTM C645 and GA 216, galvanized sheet steel, screw-type, Cee-shaped, minimum 25 gauge.

D. Ceiling Hangers: Minimum 8 gauge, galvanized, annealed steel wire.

E. Tie Wire: 16 gauge, galvanized, annealed steel wire.

F. Anchorage to Substrate: Tie wire, screws, nails and other metal supports, of type and size to suit application; to rigidly secure materials in place.

2.03 SUSPENDED GYPSUM BOARD CEILING GRID SYSTEM

A. USG Drywall Suspension Systems – Commercial quality, cold-rolled steel, hot dipped galvanized finish.

1. Main Tees: Fire-Rated Heavy-Duty classification 1.617” high x 144” long, integral reversible splice with knurled face. (DGLW-26 1-1/2” Face and 1.617” high)

   a. Cross Members: Fire-Rated members with knurled face. Cross Tees: DGLW-424 cross tee 1-1/2” high x 48” long with 1-1/2” wide face; DGLW-224 Fire-Rated: 1-1/2” high x 24” long with 1-1/2” face.

2. Quick release cross tee ends for positive locking and removability without tools.

3. Accessory Cross Tees: Cross tees must have knurled faces and quick release cross tee ends for positive locking and removability without tools.

   a. DGW-6026DM: 1.617” high x 5’ long with a 1-1/2” face
   b. DGW-7226DM: 1.617” high x 6’ long with a 1-1/2” face
   c. DGW-8426DM: 1.617” high x 7’ long with a 1-1/2” face
   d. DGW-9626DM: 1.617” high x 8’ long with a 1-1/2” face

4. Wall Moldings: Single web with knurled face

   a. DGWM-24: 1-1/2” x 1” x 144” long wall molding
   b. DGCM-27: 144” x 1-5/8” x 1” x 1” channel molding
   c. DGLC-12: 144” x 1-3/4” x 1” x 1” index channel molding

5. Accessories

   a. DGSC-180: Splice Clip
   b. DGTC-90: Transition Clip
   c. DGWC: Wall Attachment Clip
   d. DGSP-180: Splice Plate

e. DGHUB: Dome Hub
f. CMAC-1: Close Mount Attachment Clip

6. Wire: Hanger Wire 12 ga., galvanized or as noted on drawings

B. USG Drywall Wall-to-Wall Suspension Systems – Commercial quality, cold-rolled steel, hot dipped galvanized finish for use in corridors and short span applications.

1. Main Tees: Fire-Rated Heavy Duty classification 1.617" high x 6', 8', 10', 12', 14' or Custom long, integral reversible splice with 1-1/2" knurled face.
2. Wall Moldings: Single web with knurled face, 1-1/2" x 1" x 12' long, DGWM24
3. Wall Channel: Single web with knurled face, 1-5/8" x 1" x 12' long, DGCM27
4. Locking Wall Channel: Single web with knurled face, 1-3/4" x 1" x 12' long, DGLC-12

C. Grid Suspension Assemblies: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL or architect approved equal.

2.04 MANUFACTURERS – GYPSUM BOARD

A. Subject to compliance with requirements, provide products by one of the following:

1. USG Corporation
2. Gold Bond Building Products
3. Lafarge
4. Georgia-Pacific Co.

B. Limitations:

1. Do not expose to sustained temperatures exceeding 125º F.

2. Do not expose to excessive, repetitive or continuous moisture before, during or after installation. Eliminate sources of moisture immediately.

3. Not suitable for use in high-moisture areas such as tub and shower enclosures, gang showers and other areas subject to direct water exposure.

4. Non-loadbearing.

5. For abuse-resistant construction over steel framing, minimum 20-gauge studs at a maximum of 16" on center are required.

6. Application of Sheetrock Mold Tough AR gypsum panels over insulating blanket, installed continuously across the framing members is not recommended. Blankets should be recessed and blanket flanges attached to sides of studs or joists.

C. Finishing and Decorating:

1. Painting products and systems should be used that comply with recommendations and requirements in Appendices of ASTM C-840. For priming and decorating with paint, texture or wall covering, follow those manufacturer's directions for materials used.

2. All surfaces, including applied joint compound, must be thoroughly dry, dust-free and not glossy. Prime with Sheetrock brand First Coat primer, or with an undiluted, interior latex flat paint with high-solids content. Allow to dry thoroughly before decorating.

3. To improve fastener concealment, where gypsum panel walls and ceilings will be subjected to

severe artificial or natural side lighting and be decorated with a gloss paint (eggshell, semi-gloss or gloss), the gypsum panel surface should be skim-coated with joint compound. This equalizes suction and texture differences between the drywall face paper and the finished joint compound before painting. As an alternative to skim coating, or when a Level 5 finish is required, use manufacturer's Tuff Hide primer-surfacer.

D. Fire Protection:

1. 5/8" panels are UL Classified. Provide one- and two-hour Fire Ratings when used in accordance with UL designs U420, U442, U445, U451, U465, U466, U467 and U468. The gypsum core meets requirements for noncombustible construction.

2.05 GYPSUM PANEL PRODUCTS

TYPE I – ABUSE - MOISTURE - AND MOLD-RESISTANT TYPE X GYPSUM PANEL
To be used at all rated and non-rated interior gypsum board partitions and rated ceiling assemblies.

A. ASTM C1396, Standard Specification for Gypsum Board, for 5/8 in., Type X and water-resistant gypsum wallboard.

B. Basis of Design: Subject to compliance with project requirements, the design is based on the following: United States Gypsum Company, USG Sheetrock® Brand Mold Tough® AR Firecode® X Panels.

1. UL Type Designation: "AR".

2. ASTM E136 Noncombustibility.

3. Meets the following ASTM E84 Surface-Burning Characteristics.

a. Flame Spread: 15
b. Smoke Developed: 5
c. Class A

4. Meets the following ASTM C473, Standard Test Methods for Physical Testing of Gypsum Panels Products.

a. Core Hardness
1) Field - Not less than 11 lbf
2) End - Not less than 11 lbf
3) Edge - Not less than 11 lbf

b. Flexural Strength
1) Parallel - Not less than 46 lbf
2) Perpendicular - Not less than 147 lbf

c. Nail Pull Resistance - Not less than 87 lbf
d. Humidified Deflection - Not greater than 5/8 in.
e. Average Water Absorption - Not greater than 5% by weight after two-hour immersion

5. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. Meets ASTM C1396 specifications.

6. Thickness: 5/8 in.

7. Length: 8-12 ft.

8. Width: 4 ft.

9. Weight: 2.8 lb./sq. ft.

10. Edge: Tapered

C. ASTM C1629, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

1. Abrasion Resistance per ASTM D4977: Level 2
2. Indentation Resistance per ASTM D5240: Level 1
3. Soft-Body Impact Resistance per ASTM C1629: Level 2
4. Hard-Body Impact Resistance per ASTM C1629: Level 1

TYPE IA – HIGH – ABUSE – MOISTURE - AND MOLD-RESISTANT TYPE X GYPSUM PANEL

To be used at all rated and non-rated interior gypsum board partitions requiring High Impact wall Assemblies as noted on the Drawings.

A. ASTM C1396, Standard Specification for Gypsum Board, for 5/8 in., Type X and water-resistant gypsum wallboard.

B. Basis of Design: Subject to compliance with project requirements, the design is based on the following: United States Gypsum Company, USG Sheetrock® Brand Mold Tough® VHI Firecode® X Panels.

1. UL Type Designation: “AR”.

2. ASTM E136 Noncombustibility.

3. Meets the following ASTM E84 Surface-Burning Characteristics.

a. Flame Spread: 15
b. Smoke Developed: 5
c. Class A

4. Meets the following ASTM C473, Standard Test Methods for Physical Testing of Gypsum Panels Products.

a. Core Hardness
1) Field - Not less than 11 lbf
2) End - Not less than 11 lbf
3) Edge - Not less than 11 lbf

b. Flexural Strength
1) Parallel - Not less than 46 lbf
2) Perpendicular - Not less than 147 lbf

c. Nail Pull Resistance - Not less than 87 lbf
d. Humidified Deflection - Not greater than 5/8 in.
e. Average Water Absorption - Not greater than 5% by weight after two-hour immersion

5. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. Meets ASTM C1396 specifications.

6. Thickness: 5/8 in.

7. Length: 8-12 ft.

8. Width: 4 ft.

9. Weight: 2.8 lb./sq. ft.

10. Edge: Tapered

C. ASTM C1629, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

1. Abrasion Resistance per ASTM D4977: Level 2
2. Indentation Resistance per ASTM D5240: Level 2
3. Soft-Body Impact Resistance per ASTM C1629: Level 3
4. Hard-Body Impact Resistance per ASTM C1629: Level 3

TYPE II – GLASS-MAT TILE BACKERBOARD

To be used at all wall surfaces scheduled to receive wall tile finishes.

A. ASTM C1178, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel, for 5/8” in., Glass-Mat Tile Backerboard.

1. Basis of Design: Subject to compliance with project requirements, the design is based on the following: USG Durock™ Glass-Mat Tile Backerboard.

a. Thickness: 5/8 inch.

b. Board Length: 8 feet.

c. Board Width: 48 inches.

d. Mold Resistance: ASTM D 3273, score of 10.

2. Fastener Requirements: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.

a. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: DUROCK Tile Backer Screws 1-5/8 inch.

b. Wood Screws: DUROCK Tile Backer Screws for wood framing 1-5/8 inch.

3. Panel Installation Requirements:

a. Install backerboard with ends and edges closely abutted but not forced together. Stagger end joints in successive courses.

b. For flooring applications over a wood-based substrate, laminate USG Durock™ Glass-Mat Tile Backerboard to subfloor using Type 1 organic adhesive or latex-modified thin-set mortar suitable for bonding cement board. Fasten to subfloor with 1-1/4" USG Durock™ Brand Tile Backer Screws for wood framing (or equivalent) spaced 8" o.c. in both directions with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges. Drive screws so bottoms of heads are flush with panel surface to ensure firm panel contact with subfloor. Do not overdrive fasteners. Prefill joints with tilesetting mortar or adhesive and then immediately embed USG Durock™ Brand Tile Backer Tape and level joints.

c. For wall application, fasten USG Durock™ Glass-Mat Tile Backerboard to framing with

specified fasteners. Drive fasteners into field of panels first, working toward ends and edges. Hold panels in firm contact with framing while driving fasteners. Space fasteners maximum 8" o.c. for walls, 6" o.c. for ceilings, with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges. Drive screws so bottoms of heads are flush with panel surface. Do not overdrive fasteners. Approved fasteners include: USG Durock™ Tile Backer Screws for steel framing (or equivalent), 1-5/8" for 14- to 20-gauge steel framing; USG Durock™ Tile Backer Screws for wood framing (or equivalent), 1-5/8" for wood framing. Prefill joints and then immediately embed USG Durock™ Tile Backer Tape and level joints. Maintain 1/4" gap between USG Durock™ Glass-Mat Tile Backerboard and tub surround.

d. Panels should be cut to size with a knife and straight edge. A power saw should be used only if it is equipped with a dust-collection device. Installer should wear NIOSH/MSHA-approved dust mask.

e. If waterproofing is required, treat joints and fastener penetrations with USG Durock™ Brand Waterproofing Membrane or equivalent ANSI A118.10 waterproofing membrane. Refer to the current USG Durock™ Brand Waterproofing Membrane submittal sheet (CB595) or waterproofing membrane manufacturer's installation recommendations. For technical assistance, call USG Technical Service at 800 874-4968.

f. In areas where standing water could occur on horizontal surfaces, such as shower benches or niches, waterproofing is required with USG Durock™ Waterproofing Membrane or equivalent ANSI A118.10 waterproofing membrane. Refer to the current USG Durock™ Brand Waterproofing Membrane submittal sheet (CB595) or waterproofing membrane manufacturer's installation recommendations.

4. Application Limitations:

a. Tile must be applied on the gray-coated side of panel. Panels are designed for interior use only and should not be used around fireplaces or areas where prolonged exposure to heat exceeds 125°F (52°C) or for exterior applications. Use framing or furring when applying over concrete or masonry block. Install vapor retarders suitable for bonding tiles on the face of the panels.

b. For wall applications, maximum stud spacing: 16" o.c. (24" o.c. for cavity shaft wall assembly). Framing shall be designed (based on stud properties alone) not to exceed L/360 deflection for tile and thin brick. Maximum fastener spacing: 8" o.c. for wood and steel framing; 6" o.c. for ceiling applications.

c. Floor applications, maximum joist spacing 24" o.c. The subfloor system should be designed with a maximum deflection limit of L/360 for the span. Some finish materials may require a more rigid subassembly (such as large format tile and natural stone products). In these cases, follow the manufacturer's minimum requirements. The subfloor shall be APA Span-Rated Plywood or OSB with an Exposure 1 classification or better with tongue and groove or back blocked at the unsupported edges.

d. Ceiling maximum dead load 7.5 psf.

e. Steel framing must be 20-gauge equivalent or heavier.

f. Consult manufacturers information on finishing limitations.

1) Do not use drywall screws or drywall nails.
2) Do not use drywall joint tape.
3) Do not use with vinyl flooring or over a concrete subfloor.

g. USG Durock™ Glass-Mat Tile Backerboard is not designed for use as a structural panel.

h. Panels should not be used in select wet areas including commercial saunas or steam rooms, gang showers, or shower pan bases.

i. Waterproofing membrane must be used over USG Durock™ Glass-Mat Tile Backerboard in select wet areas including indoor hot tub decks, shower benches and niches, tiled wall and ceiling applications in indoor pool areas, and tiled wall and ceiling applications in residential steam rooms, per ANSI A118.10.

TYPE III – MOISTURE- AND MOLD-RESISTANT TYPE X GYPSUM SHAFTLINER PANEL

To be used at all rated and non-rated interior gypsum board shaft wall and area separation wall systems.

A. ASTM C1396, Standard Specification for Gypsum Board, for 1 in., Type X and water-resistant shaftliner board.

B. Basis of Design: Subject to compliance with project requirements, the design is based on the following: United States Gypsum Company, USG Sheetrock® Brand Mold Tough® Gypsum Liner Panels.

1. UL Type Designation: “SLX”.

2. ASTM E136 Noncombustibility.

3. Meets the following ASTM E84 Surface-Burning Characteristics.

   a. Flame Spread: 20
   b. Smoke Developed: 0
   c. Class A

4. Meets the following ASTM C473, Standard Test Methods for Physical Testing of Gypsum Panels Products.

   a. Core Hardness
      1) Field - Not less than 11 lbf
      2) End - Not less than 11 lbf
      3) Edge - Not less than 11 lbf

   b. Flexural Strength
      1) Parallel - Not less than 77 lbf
      2) Perpendicular - Not less than 228 lbf

   c. Nail Pull Resistance - (Not Required)
   d. Humidified Deflection - (Not Required)
   e. Average Water Absorption - Not greater than 5% by weight after two-hour immersion

5. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. Meets ASTM C1396 specifications.

6. Thickness: 1 in.

7. Length: 8 ft., 10 ft. 12 ft.

8. Width: 2 ft.

9. Weight: 4.0 lb./sq. ft.

10. Edge: Double-beveled

TYPE IV – LIGHTWEIGHT MOISTURE - AND MOLD-RESISTANT GYPSUM PANEL
To be used at all non-rated ceilings and soffits.

A. ASTM C1396, Standard Specification for Gypsum Board, for 1/2 in., water-resistant gypsum wallboard.

B. Basis of Design: Subject to compliance with project requirements, the design is based on the following: United States Gypsum Company, USG Sheetrock® Brand UltraLight Panels Mold Tough®.

1. UL Type Designation: Not applicable

2. ASTM E136 Noncombustibility.

3. Meets the following ASTM E84 Surface-Burning Characteristics.

   a. Flame Spread: 15
   b. Smoke Developed: 0
   c. Class A

4. Meets the following ASTM C473, Standard Test Methods for Physical Testing of Gypsum Panels Products.

   a. Core Hardness
      1) Field - Not less than 11 lbf
      2) End - Not less than 11 lbf
      3) Edge - Not less than 11 lbf

   b. Flexural Strength
      1) Parallel - Not less than 36 lbf
      2) Perpendicular - Not less than 107 lbf

   c. Nail Pull Resistance - Not less than 77 lbf
   d. Humidified Deflection - Not greater than 1-1/4 in.
   e. Average Water Absorption - Not greater than 5% by weight after two-hour immersion

5. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. Meets ASTM C1396 specifications.

6. Thickness: 1/2 in.

7. Length: 8-12 ft.

8. Width: 4 ft.

9. Weight: 1.35 lb./sq. ft.

10. Edge: Tapered

2.06 GYPSUM BOARD ACCESSORIES

A. Provide gypsum wallboard accessories in accordance with GA 216.

B. Each interior sealant and adhesive product must meet the VOC limits specified in Section 013563 "*LEED Requirements*".

C. Fasteners: Screws ASTM C1002, self-drilling, self-tapping, Bugle Head, for use with power driven tool.

1. Type "S": for wallboard application to sheet metal framing

2. Type "W": for wallboard application to wood framing.

3. Length:

a. 1 inch (25 mm) for single layer construction.

b. 1 5/8-inches (41 mm) for double layer construction.

4. For Fire Rated Construction: Same type and size as used in fire rating test.

5. For Other Applications: Type and size as recommended by gypsum board manufacturer.

D. Metal Trim Accessories: Size required for thickness of wallboard used, fabricated from galvanized steel and roll-formed zinc, or other corrosion-resistant treatment. All metal trim shall be 25 gauge, manufactured by *USG Corporation* under the following numbers or approved equal:

1. Corner Beads: Formed galvanized steel angle, 1/8-inch round bead, 1-1/4-inch perforated metal flanges, ASTM C1047, similar or equal to *"Dura-Bead"*.

2. Edge Trim: Formed galvanized steel casing bead, 0.014-inch-thick base steel, face nailed, reveal bead and exposed metal flange surface finished with joint compound, ASTM C1047.

3. Control Joints: Manufacturer's standard roll-formed zinc with 1/4-inch; "V"-shaped slot protected by plastic tape, for face application, exposed flange surfaces finished with joint compound, ASTM C1047; similar or equal to No. 093.

4. Casings: No. 400.

5. Wall to Wall (corner) Expansion Joints: *Wabo ECC-200* corner coverplate, aluminum alloy 6063-TS or 6061-T6, mill finish. Paint as per Section 099000.

E. Joint Treatment Materials:

1. Joint Tape: ASTM C475; paper reinforcing tape, perforated.

2. Joint Compound: ASTM C475; drying type pre-mixed vinyl base compounds, as manufactured by the approved manufacturer of the gypsum board.

3. Laminating Adhesive: Manufacturer's recommended laminating adhesive or liquid contact adhesive for double-layer systems.

F. Adhesive: Similar or equal to USG Durabond 90.

G. Adhesive VOC content must be less than 50 g/L.

H. Special Architectural Metal Drywall Profiles: Furnish and install, where indicated on Contract Drawings, extruded and roll-formed Architectural profiles *"Softforms"* as manufactured by *Pittcon*

Industries, Inc., Riverdale, MD. Subject to compliance with requirements, provide the named product or a comparable product.

1. Designs:

   a. Corners: Custom Inside Corner, Model #SI-LRt, 6-inch inside radius by 90 degrees.

   b. Reveals: Wall Reveal, Model #SWR-200-050, 2-inch wide by 15/32-inch deep.

   c. Grooves: V-Groove, Model #SWR-100V-050, 1-inch wide by 45 degrees.

2. Material: Extrusions shall be of 6063 T5 aluminum alloy, and roll formed shapes shall be of 3003 H-14 aluminum alloy.

3. Construction: Profile shall incorporate continuous integral tapering fins for surface contact, 7/8-inch wide. Fins shall be punched with ¼-inch holes staggered ½-inch o.c. to accept standard screw fastening.

4. Finish: Profiles shall receive a factory-applied, high porosity, corrosion-resistant primer compatible with materials commonly in use in conjunction with commercial interiors, i.e. – joint compound, latex or enamel paints, and wall covering adhesives.

2.07 ACOUSTICAL ACCESSORIES

A. Sound Attenuation Fire Blankets:

1. Manufactured from slag wool fiber.

2. Unfaced batts in manufacturers' standard thickness to fit cavity in compliance with manufacturers Sound and Fire-Rated SAFB Assemblies.

3. Length: 48 inches.

4. Batts shall have a density of 2.5 lbs. per cu.ft.

5. R-Value, per 1-inch thickness: 3.7.

6. Flame Spread and Smoke Developed (ASTM E84, Surface Burning Characteristics): 0.

B. Basis-of-Design Product: The design for Slag Wool Fiber is based on *Thermafiber, Sound Attenuation Fire Blankets* (SAFB). Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Owens Corning.
2. Fibrex Insulations, Inc.

C. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board; type as recommended by gypsum manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on Contract Drawings and approved shop drawings.

3.02 METAL STUD INSTALLATION - GENERAL

A. Install metal stud framing in accordance with manufacturer's instructions, and ASTM C754, except as otherwise specified herein.

B. Install members true to lines and levels to provide surface flatness with maximum variation of 1/8-inch in 10 feet in any direction.

C. Align all partitions accurately according to layout. Runners shall be attached to concrete slab or other type of floor 24 inches on center with concrete stub nails or power-driven anchors, to suspended ceilings with toggle bolts, or to slab above where indicated.

D. Position studs vertically in runners, spaced 16 inches on center maximum.

E. Anchor all studs adjacent to door frames and at partition intersections and corners, to runner flanges with metal lock fasteners, or positive screw engagement through each stud and runner flange.

F. When necessary, studs shall be spliced by nesting 2 studs with a minimum lap of 8 inches, attaching flanges with 2 screws per flange.

G. Provide horizontal bracing of studs at mid-point in partition height. Bracing shall be standard metal stud cut to fit and secured to studs.

H. Metal studs at door frames shall be erected 2" maximum from frames and as follows:

1. Anchor door frame clips to studs securely by bolt or screw attachment.

2. Doors 2'-6" and wider shall be framed with double studs, placed back to back.

3. Over door frames, install a section (cut to length) of runner with slip flanges and bent web to allow flanges to overlap adjacent vertical studs; screw attach all components.

4. Position a stud at the locations of vertical joints in wallboard over door frames. Stud shall extend from frame header to the ceiling runner.

I. Unless otherwise indicated or specified, the suspension system for gypsum board ceilings and soffits shall consist of runner channels and furring channels, suspended by hanger bars or hanger rods.

3.03 INSTALLATION OF FLOOR AND CEILING TRACKS

A. Align floor and ceiling tracks.

B. Attach metal runners at floor and ceiling to structural elements with appropriate power-driven fasteners.

C. Attach tracks to structure with fasteners located 2 inches from each end and spaced at a maximum of 24 inches on center.

D. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

3.04 INSTALLATION OF METAL STUD

A. Plumb and align studs.

B. Space studs at 16 inches on center, unless otherwise indicated.

C. Attach studs to floor and ceiling tracks by crimping flange of runner track, screwing, tack welding or method as recommended by stud manufacturer.

D. If necessary, splice studs by nesting with minimum lap of 8 inches.

E. Refer to Contract Drawings for indication of partitions extending to finished ceiling only, and for partitions extending through the ceiling to the structure above.

3.05 INSTALLATION OF FRAMING AROUND DOORS AND LIGHT OPENINGS

A. Install double studs at each jamb of door, continuous for full height of partition.

B. Attach stud track horizontally on each side of opening, at frame head height.

1. Install jack studs at 16 inches on centers over head of door frame.

2. Attach jack studs to runner track and anchor top in same manner as provided for full studs.

3. Screw, bolt or weld stud to jamb anchors of frame, as recommended by stud manufacturer.

4. Anchor a second stud to stud at doorjamb, as recommended in manufacturer's printed instructions, nested to form a box.

5. Provide headers above and below framed wall openings having an area of 2 square feet or more.

3.06 CORNERS AND INTERSECTIONS

A. Form corners and intersection of partitions with three studs as detailed in ASTM C754, Fig. 2 and Fig.3, as detailed on drawings. Two stud corner construction is not acceptable.

B. Place studs forming internal corners 2 inches (50 mm) from point of partition intersections.

3.07 BLOCKING

A. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and other similar items.

3.08 INSTALLATION – WALL FURRING

A. Attach wall furring for direct attachment to concrete block and/or concrete walls.

B. Erect furring channels horizontally or vertically; space maximum 16" (400 mm) on center, not more than 4 inches (100 mm) from floor and ceiling lines or abutting walls. Secure in place on alternate channel flanges at maximum 24" on center.

C. Where furring channels are installed directly to exterior walls and a possibility of moisture penetration through walls exists, install asphalt felt paper protection strip between the channel and wall.

3.09 INSTALLATION – CEILING FRAMING

A. Space 8 gauge hanger wire 48" on centers along carrying channels and within 6" of ends of channel run.

B. Install carrying channels 48" on centers and within 6" of walls.

C. Position channels for proper ceiling height, level, and secure with hanger wire saddle-tied along channel.

D. Interlock flanges, at channel splices, and overlap ends 12" and secure each end with double-strand 18 gauge tie wire.

E. Erect metal furring channels at right angles to carrying channels or support members. Space furring channels 16” o.c. and within 6" of walls.

F. Secure furring to carrying channels with clips or saddle-tie with double-strand 16 gauge tie wire.

G. Nest furring channels at least 8" at splices, and securely wire-tie each end with double-strand 18 gauge tie wire.

3.10 INSTALLATION – SUSPENDED CEILING GRID SYSTEM

A. General Installation Requirements:

1. Standard reference: Install grid members in accordance with ASTM C636, CISCA installation standards, and other applicable references.

2. Manufacturer’s reference: Install in accordance with manufacturer’s current printed recommendations.

3. Drawing reference: Install in accordance with approved shop drawings and locate ceiling in accordance with main tee dimensions relative to elevations.

4. Install in accordance with reference standards and manufacturer's instructions and as required to comply with seismic requirements.

B. Flat Ceiling Applications

1. Hanger Wire Installation: Secure hanger wires to upper structural elements and space hangers so that each hanger wire supports a maximum of 16 sq. ft.

2. Space main tee members a maximum span of 48” on center (or as specified by the UL Fire Resistance Directory)

3. Space cross tees recommended 16” o.c. (5/8” SHEETROCK Brand gypsum Board or 5/8” FIBEROCK Interior panels can span 24” o.c. Check USG AC3095, for maximum allowable spacing based on wind load) (or as specified by the UL Fire Resistance Directory) Install extra cross tees where butt joints occur, 8” from each side of the butt joint.

4. Install compression struts per manufacturer’s specifications and spacing, in accordance with wind load if applicable. Adjust main and cross tee spacing as necessary for loading conditions. (See AC3095, USG)

5. Install fiber glass insulation in plenum, resting on top of main tees and cross members, as indicated on the drawings.

6. Do not install insulation within 3” of light fixtures unless fixtures are approved for use with insulation.

7. Limit insulation thickness so that combined weight of supported panels and insulation on grid

main tees does not exceed 16 plf.

8. Attach SHEETROCK gypsum Board or FIBEROCK Interior panels to the suspension system main runners, cross tees, and cross channels with 1-1/4" bugle head screws – single layer of board spaced 16" o.c. – SHEETROCK gypsum Board and 8" o.c.- FIBEROCK in the field and at the perimeter of the panels, locate 3/8" in from panel edges. Hold panels in firm contact with framing while driving fasteners. Drive fastener heads flush with, or slightly below surface.

9. Install trim, and similar accessories as necessary and as applicable to meet project requirements where indicated on drawings.

10. Install control joints at locations of properly detailed control joints, including additional cross tees as necessary, per direction of architect and/or design professional.

11. Finish boards as described to achieve 'Level of Finish' specified.

C. Corridor (Wall-to-Wall) Applications

1. Hanger Wire Installation: Secure hanger wires to upper structural elements and space hangers so that each hanger wire supports a maximum of 16 sq. ft.

   a. Note:
   If using ½" single layer of drywall no hangers are required for spans up to 7'-0" (L/240 uniform load, single span design).
   If using 5/8" single layer of drywall no hangers are required for spans up to 6'-0" (L/240 uniform load, single span design).
   If using ½" single layer of drywall for spans over 7'-0" to 14'-0" one hanger at mid span per each main is required (L/240 uniform load, single span design).
   If using 5/8" single layer of drywall for spans over 6'-0" to 12'-0" one hanger at mid span per each main is required (L/240 uniform load, single span design).
   If using 5/8" single layer of drywall for spans over 12'-0" to 14'-0" two hangers at 1/3 point per each main is required (L/240 uniform load, single span design).

2. Space main tee members as required by span and design load

   a. Note:

Maximum load (lbs/sf)	Unsupported span	Main tee spacing
18	4'-0"	16" o.c.
12	4'-0"	24" o.c.
9.2	5'-0"	16" o.c.
6.1	5'-0"	24" o.c.
5.3	6'-0"	16" o.c.
3.6	6'-0"	24" o.c.
3.4	7'-0"	16" o.c.

3. Attach SHEETROCK gypsum board and FIBEROCK interior panels to the suspension system main runners, cross tees, and cross channels with 1-1/4" bugle head screws – single layer of board spaced 16" o.c. – SHEETROCK gypsum Board and 8" o.c.- FIBEROCK in the field and at the perimeter of the panels, locate 3/8" in from panel edges. Hold panels in firm contact with framing while driving fasteners. Drive fastener heads flush with, or slightly below surface.

4. Install trim, and similar accessories as necessary and as applicable to meet project requirements where indicated on drawings.

5. Install control joints at locations of properly detailed control joints, including additional cross tees as necessary, per direction of architect and/or design professional.

6. Finish boards as described to achieve 'Level of Finish' specified.

D. Curved, vaults, or dome applications

1. Drawing reference: Install in accordance with approved shop drawings and locate ceiling in accordance with main tee dimensions relative to elevations.

2. Hanger Wire Installation: Secure hanger wires to upper structural elements and space hangers so that each hanger wire supports a maximum of 12 sq. ft.

   a. Note: Curved surfaces can be achieved with the attachment of panels, however, in order to achieve the best application, plaster is recommended. Due to the width of the grid flange (greater than ¾") STRUCTO-BASE gypsum basecoat plaster should be used to reduce cracking. If other gypsum plasters or portland plaster are being used then it is recommended to secure narrow flanged framing members or offset the metal lath to reduce cracking due to reduced mechanical key at framing/lath intersection. Total weight of ceiling membrane plus overlaid insulation and surface finish material (e.g. ceramic tile) supported by the grid assembly should not exceed 4.0 psf. If the load exceeds 4.0 psf, then spacing of the hanger wires and/or main tees must be reduced (see sample calculation below). For guidance the following are design weights:

1/2" SHEETROCK Exterior Gypsum Ceiling Board	2.0 psf
5/8" SHEETROCK Exterior Gypsum Ceiling Board	2.5 psf
1/2" FIBEROCK Sheathing	2.2 psf
5/8" FIBEROCK Sheathing	3.0 psf

   b. If main tee hanger wires are at 4' o.c., the mains' load capacity is: 4 FT * 4 psf = 16 #/LF.
   By reducing the hanger wires to 3' o.c., the mains can carry 32 #/LF.
   By reducing the hanger wires to 2' o.c., the mains can carry 64 #/LF.

   3/4" of plaster wet would be about 8.75 #/SF + 5/8" FIBEROCK Sheathing at 3 #/SF for about 12 #/SF.

   Mains are at 4 ft centers with 4' hangers; this load would be 12 #/SF * 4 FT = 48 #/LF.
   If the Mains are at 2 ft centers with 4' hangers; this load would be 12 #/SF * 2 FT = 24 #/LF.

   Therefore, there are two options:

   1) Space the main tees at 4' o.c. with the 12 ga. hanger wire at 24" o.c. and within 8" from any wall, cross tees at 16" o.c. with hanger wire support at midspan and/or within 8" from any wall.
   2) Space the main tees at 2' o.c. with the 12 ga. hanger wire at 36" o.c. and within 8" from any wall, cross tees at 16" o.c.

3. Space main and cross tee members so the maximum span of metal lath is (16") (12")

4. Secure self-furring metal lath to tee members with screws spaced 6" o.c. max., applied at lath dimples. Lap metal lath ends and edges and secure with 18 gauge tie wire spaced 6-inches o.c.

5. Mix STRUCTO-BASE Gypsum Plaster with sand in proportions of 2 cu. ft. of sand per 100 lbs. of plaster for scratch and brown coats. Apply plaster to metal lath to a thickness of 5/8” (min.) Measured from the face of the lath.

6. Select a plaster mix for the finish coat to provide a smooth trowel or sand float (textured) finish. (Reference SA 920)

7. Use template(s) to insure uniform and even curvature of the finished surface.

3.11 FURRING FOR FIRE RATINGS

A. Install furring for fire resistance ratings in accordance with appropriate UL requirements and/or Design Numbers indicated.

3.12 INSPECTION PRIOR TO WALLBOARD INSTALLATION

A. Check framing for adequate spacing and alignment.

B. Verify that spacing of installed framing does not exceed maximum allowable for thickness of wallboard to be used.

C. Verify that frames are set for thickness of wallboard to be used.

D. Do not proceed with installation of wallboard until deficiencies are corrected and surface to receive wallboard are acceptable.

E. Protrusions of framing, twisted framing members, or unaligned members must be repaired before installation of wallboard is started.

F. Commencing installation of wallboard means “acceptance” of existing conditions.

3.13 WALLBOARD INSTALLATION - GENERAL

A. Unless otherwise specified, methods of installation shall be in accordance with the requirements of the Gypsum Association (GA-216) and the approved manufacturer’s instructions.

B. Stockpile wallboard, flat on floor in piles. Leave in original wrappings or containers until ready for use. Protect wallboard from moisture from any source.

C. Butt all wallboard joints loosely together with a 1/4" cap. Butt ends shall not be placed against tapered edges.

D. Install in maximum practical lengths to span walls without butt joints. If butt joints do occur, stagger joints and locate as far as possible from center of walls or ceilings.

E. Abut wallboard without forcing. Neatly fit ends and edges of wallboard. Do not place butt ends against tapered edges.

F. Support end joints on studs. Apply end joint compound to the back of the board along end joints.

G. No end joints shall align with edges of openings. Install expansion and/or control joints where shown or required.

H. Install metal trim at corners, edges, and elsewhere as shown in accordance with the manufacturer's instructions and recommendations.

I. Openings cut in wallboard to fit mechanical and electrical items shall fit snugly and be small enough to be covered by escutcheons and plates. Both face and back paper shall be cut when cutouts are not made with a saw.

J. Adhesive and joint finishing compounds shall be mixed in strict accordance with the manufacturer's instructions. Mix only enough at one time to be used during the recommended pot life of the compound.

K. Fasteners shall be installed as follows:

1. Install no closer than 3/8-inch to end or edge.

2. Begin from center of wallboard and proceed to outer edge.

3. Pressure shall be applied on wallboard adjacent to fasteners being driven to ensure a tight fit of wallboard to the studs.

L. Drive screws with a power screwdriver as recommended by the manufacturer. Surface of head shall finish below the surface of the paper without puncturing the paper.

M. Minimum temperature in areas where gypsum board is to be installed shall be 65°F for 24 hours before, during, and after installation. Provide adequate heat and ventilation to remove any moisture.

N. Install continuous sound absorbing blanket in partitions indicated on drawings. Installation shall be in accordance with manufacturer's directions. Sound absorbing blanket insulation shall be paperless, semi-rigid mineral fiber batts 1" thick "Thermafiber" sound attenuation blanket, flame spread rating of 15 (ASTM E-84) as manufactured by *Owens Corning* or approved equal.

3.14 INSTALLATION - WALLBOARD OVER FRAMING

A. Single Layer Construction:

1. Ceilings:

a. Gypsum wallboard shall be applied first to ceiling with long dimension at right angles to framing using panels of maximum practical length.
b. Position end joints over framing members and stagger in adjacent rows.
c. Fit ends and edges closely, do not force together. Fasten panels to furring with mechanical fasteners, spaced 12” o.c., in field of panels and along abutting ends and edges.

2. Walls:

a. Apply wallboard horizontally for wall height of 8’-0” or less, and vertically for wall height greater than 8’-0”. When installing wallboard horizontally, attach upper panel first.
b. Apply single layer fire rated wallboard vertically, with edges occurring over firm bearing.
c. Stagger end joints to occur on different framing members on opposite sides of partition.

3. Mechanical Fastening:

a. Screws:

1) Attach single layer of wallboard to metal framing with power driven screws.
2) Minimum edge clearance from mechanical fastener: 3/8”.
3) Stagger mechanical fasteners opposite each other on adjacent ends and edges.
4) Sand abutting ends or edges over support surface.

5) Space screws 16” o.c. when framing is spaced 16” o.c., or 12” o.c. when framing is spaced 24” o.c.
6) Drive screws with a positive clutch electric screwgun.

B. Double Layer Construction:

1. Ceilings:

a. Apply wallboard face layer perpendicular to edges of base layer.
b. Position end joints of face layer to offset base layer joints by at least 10”.
c. Gypsum wallboard shall be installed in such a manner to provide two-hour fire resistant rating shown, when indicated, and in accordance with requirements of UL.

2. Walls:

a. Apply wallboard base layer vertically.
b. Stagger vertical joints of base layer on opposite side of partition to occur on different framing members.
c. Apply face layer horizontally, minimum offset of joints between face layer and face layer shall be at least 10".
d. Gypsum wallboard shall be installed in such manner to provide two hour fire resistant ratings indicated, and in accordance with requirements of UL.

3. Adhesive Lamination:

a. Apply adhesive with notched spreader or caulking gun, as recommended by wallboard manufacturer, for this particular application and job condition.

4. Permanent Attachment:

a. Permanently attach face layer with specified fasteners in accordance with UL requirements for systems selected.

3.15 CONTROL JOINTS

A. Non-Rated Gypsum Construction: Gypsum panel surfaces shall be isolated with control joints or other means, as detailed and at locations indicated on the drawings, if not shown, where:

1. Partition, furring or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling;

2. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration;

3. Construction changes within plane of partition or ceiling;

4. Partition or furring run exceeds 30 ft.;

5. Ceiling dimensions exceed 50 ft. in either direction with perimeter relief, 30 ft. without relief;

6. Exterior soffits exceed 30' in either direction;

7. Wings of “L”, “U” and “T” shaped ceiling areas are joined;

8. Expansion or control joints occur in the exterior wall.

9. Less-than-ceiling height door/light frames shall have control joints extending to the ceiling from both opening corners. Ceiling height doorframes may be used as control joints.

B. Fire-Rated Gypsum Construction: Gypsum panel surfaces shall be isolated with control joints or other means, as detailed and at locations indicated on the drawings, if not shown, where:

1. A partition, wall, or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.

2. Where a wall or partition runs in an uninterrupted straight plane exceeding 30 lineal feet. NOTE: Full height door frames may be considered a control joint.

3. Interior Ceilings With Perimeter Relief: Control joints shall be installed so that linear dimensions between control joints shall not exceed 50 ft. and total areas between control joint shall not exceed 2500 sq.ft.

4. Interior Ceilings Without Perimeter Relief: Control joints shall be installed so that linear dimensions between control joints shall not exceed 30 ft. and total areas between control joint shall not exceed 900 sq.ft.

5. Exterior Ceilings and Soffits: Control joints shall be installed so that linear dimensions between control joints shall not exceed 30 ft. and total area between control joints shall not exceed 900 sq.ft.

6. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

7. A control joint is desired or incorporated as a design accent or Architectural feature.

C. Install vertical control joints in gypsum sheathing to relieve stress caused by movement in accordance with ASTM C840-08, Section 20.3.1-20.3.5

1. Control joints shall be installed where a partition, wall or ceiling traverse a construction joint (expansion, seismic or building control element) in the base building structure.

2. Control joints shall be installed where a wall or partition runs in an uninterrupted straight plan exceeding 30 linear feet.

3. Control joints in interior ceilings with perimeter relief shall be installed so that the linear dimensions between control joints do not exceed 50 feet and total area between control joints does not exceed 2,500 sq. ft.

4. Control joints in interior ceilings without perimeter relief shall be installed so that the linear dimensions between control joints do not exceed 30 feet and total area between control joints does not exceed 900 sq. ft.

5. Control joints in interior ceilings with perimeter relief shall be installed so that the linear dimensions between control joints do not exceed 30 feet and total area between control joints does not exceed 900 sq. ft.

6. Control joint or intermediate blocking shall be installed where ceiling framing members change direction.

7. Where control joints occur in an acoustical or fire rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8” Type X gypsum board, mineral fiber, or other tested equivalent.

3.16 INSTALLATION – ACOUSTICAL ACCESSORIES

A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

B. Apply acoustical sealant within partitions in accordance with manufacturer's instructions and recommended procedures.

3.17 INSTALLATION – METAL ACCESSORIES

A. Install corner beads and edge trim as specified in ASTM C840.

B. Install corner beads at all external corners.

C. Install edge trim at perimeter of openings and at juncture with other materials except, where covered by casings or flanges.

3.18 JOINT TREATMENT SYSTEM

A. Execute joint treatment in accordance with the manufacturer's printed instructions and these specifications.

B. Reinforce wall corners and angles with tape folded to conform to the contour and embed in compound.

C. Flanges of corner beads and trim shall be concealed by 2 coats of compound. Feather cut compound 9 inches from beads.

D. Sand compound when thoroughly dry; avoid roughing surfaces of finish wallboard.

E. Leave all surfaces smooth and uniform, ready to receive paint.

F. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840.

1. Level 4 – Provide at Flat or Eggshell Painted walls or ceilings.

2. Level 5 – Provide at Gloss, Semi-Gloss, Enamel, Special Wallcoverings, or where severe lighting conditions occur.

G. Taping and Finishing Joints:

1. Taping and Embedding Joints:

   a. Apply compound in thin uniform layers to all joints and angles to be reinforced.
   b. Apply reinforcing tape immediately.
   c. Center tape over joint, and seat tape into compound.
   d. Leave approx. 1/64" to 1/32" compound under tape to provide bond.
   e. Apply skim coat immediately following tape embedment, but not to function as fill or second coat.
   f. Fold tape and embed in at inside corners to provide true angle.
   g. Allow embedding coat to thoroughly dry prior to application of fill coat.

2. Filling:

   a. Apply second coat of joint compound over embedding coat.

b. Fill taper flush with surface.
c. Apply fill coat to cover embedding coat.
d. Feather out fill coat beyond embedding coat and previous joint compound line.
e. Joints with no taper: Feather out at least 4” on either side of tape.
f. Do not apply fill coat on interior angles.
g. Allow fill coat to thoroughly dry prior to application of finish coat.

3. Finishing:

a. Spread joint compound evenly over and beyond fill coat on all joints.
b. Feather coats onto adjoining surfaces so that camber is maximum 1/32” to 1/16”., and to a smooth, uniform finish.
c. Apply finish coat to taped inside angles to cover tape and taping compound.
d. Sand final application of compound to provide a smooth surface, ready for decoration.

H. Filling and Finishing Depressions:

1. Apply joint compound as first coat to fastener and other depressions.
2. Apply at least two additional coats of compound after first coat is dry.
3. Leave filled and finished depressions level with plane of surface.

I. Finish Beads and Trim:

1. First Fill Coat:

a. Apply joint compound to beam and trim.
b. Feather out first coat from ground to plane of wallboard surface.
c. Allow compound to thoroughly dry prior to application of second fill coat.

2. Second Fill Coat:

a. Apply joint compound in same manner as first coat.
b. Extend beyond first coat onto face of wallboard.
c. Allow compound to thoroughly dry prior to application of finish coat.

3. Finish Coat:

a. Apply joint compound in same manner as second coat.
b. Extend beyond second fill coat.
c. Feather out finish coat from ground to plane of wallboard surface.
d. Sand finish coat to provide a flat surface ready for decoration.

4. Taping, filling and sanding is not required at surfaces behind adhesive applied ceramic tile.

3.19 AIRTIGHT DRYWALL OR RETURN AIR PLENUM SPACES

A. Finish all drywall plenum construction below access floor or above finished ceiling.

1. Finish Level: Level 1.

a. Seal all pipes, ducts, conduit and other penetrations.
b. Seal perimeter of all drywall to floors and deck above with sealant.

3.20 INSTALLATION OF ACCESS PANELS

A. Install metal access panels and rigidly secure in place, as required by other sections and other

trades.

B. Install in accordance with manufacturer's printed instructions and requirements of regulatory agencies, when applicable.

C. Coordinate the installation of rough bucks, anchors, blocking, mechanical and electrical work which is to be placed in or behind wall framing and ceiling furring. Allow such items to be installed after framing and furring is complete.

3.21 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8” in 10 feet, in any direction.

3.22 PATCHING AND REPAIRING

A. After trim is applied, correct all surface damage and defects as required, to the Architect's satisfaction, so that blemishes will not show through the decoration.

B. If, in the opinion of the Architect, the wallboard is irreparable, the Contractor shall remove same and replace it with new material at no extra cost to the Owner.

C. Punctures:

1. When face paper is punctured, drive new nail approximately 1 1/2" from defective fastening and remove defective fastener.

2. Fill all damaged surface areas with compound.

3. Leave clear depression to receive tape.

4. Permit prefill joint compound to harden prior to application of tape.

D. Ridging:

1. Do not repair ridging until condition has fully developed; approximately six months after installation of one heating season.

2. Sand ridges to receive reinforcing tape without cutting through tape.

3. Fill concave areas on both sides of ridge with topping compound.

4. After fill is dry, blend in topping compound over repaired areas.

E. Cracks:

1. Fill all cracks with compound and finish smooth and flush.

3.23 INSPECTION

A. Wall surface, when prepared for painting, shall be inspected and approved by the Architect before proceeding further.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 093013 – PORCELAIN AND GLAZED CERAMIC TILE

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, equipment and services and perform all operations required to complete the installation of all work of this Section and related work as indicated on the drawings and specified herein, including, but not limited to, the following:

1. Ceramic and Porcelain tile floors, bases, and walls in rooms and spaces indicated on Finish Schedule on drawings.
2. Grouting and cleaning all tile work under this section.
3. Cutting, fitting and drilling.
4. Protection and replacement.
5. Additional materials.
6. Caulk joints to match grout at floor, inside corners, and at door frames.
7. Sealer for gypsum board to receive tile.
8. Marble saddles.

1.02 RELATED WORK

A. Related work specified under other sections of the specifications:

1. Section 079200 – Joint Sealants
2. Section 092900 – Gypsum Wall Board
3. Section 102813 – Toilet Accessories

1.03 CONTRACT DOCUMENTS

A. Applicable provisions of the “Conditions of the Contract” shall govern all work under this Section.

1.04 QUALITY ASSURANCE

A. All ceramic tile shall be Standard Grade, of domestic manufacture and shall conform to ANSI A137.1.

B. All Porcelain tile shall be Standard Grade, of domestic manufacture and shall conform to ANSI A137.3.

C. Dry-Set Portland Cement Mortar (Thin-set) shall conform to ANSI A118.1.

D. Installation Specifications: 2020 Handbook for Installation by the Tile Council of North America.

1.05 SUBMITTALS

A. Samples:

1. The Contractor shall, before placing order for tile, submit to the Architect for approval a complete and full set of all tiles, representative of the different sizes, shapes, colors, textures, and finish to be used in the work.

2. Each sample shall be labeled stating the grade. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.

3. Stone Thresholds.

B. Before proceeding with the tile work, the Contractor shall furnish the Architect with a certificate of Grade (signed by both tile manufacturer and subcontractor) in form adopted by the Tile Manufacturer's Association, Inc., stating the grade, type of tile, identification marks for tile containers, and the name and location of the project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in unopened, original containers bearing manufacturer's labels. Store materials in a clean, dry, protected place and do not leave exposed to the weather. Take all precautions to prevent intrusion of foreign matter. Handle all materials with proper care to prevent damage of any kind.

B. Delivered materials shall match approved samples in all respects.

C. Tile containers shall be branded with, or have sealed within, the shipping mark and other designations corresponding with the information given on the master grade certificate.

1.07 JOB CONDITIONS

A. Tile work shall not be installed in freezing or near freezing weather.

1.08 GUARANTEE

A. The Contractor shall guarantee in writing to the Architect that his work will remain in place without coming loose or cracking, whatever the cause or other defects due to faults of materials or workmanship or method of setting for a period of one year after the acceptance of the building by the Owner, and that he will, within time, upon notification in writing, immediately replace any defective work or materials and restore all damage to adjoining work caused thereby at his own expense and without cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Ceramic tile, porcelain tile and base shall be as manufactured by American-Olean Corporation, Dal-Tile Corporation, Crossville or approved equal.

B. Ceramic tile type, size, color and pattern for walls, wainscots and base shall match existing where appropriate or as indicated on the Finish Floor Plans, Schedule and/or Interior Wall Elevations. If ceramic tile type, size, color and pattern are not specified herein, 30 percent of the total amount of all ceramic tile shall be of price group 3, 3"x6" format, from the Classic Color Wheel collection by Dal-Tile. The remaining 70 percent of the total amount of all ceramic tile shall be of price group 2, 3"x6" format, from the Classic Color Wheel collection by Dal-Tile.

C. When scope requires new installation of BOTH floor and wall tile, provide 3"x6" ceramic tile flat top cove base at full perimeter unless otherwise noted. Include both left and right corners as required by layout.

D. When scope requires installation of new wall tile ONLY (existing floor tile to remain), provide Schluter Dilex- AHKA Sanitary Cove Base at full perimeter. Finish to be selected by Architect.

E. When scope calls for painted wall surface with installation of new porcelain floor tile ONLY, provide ceramic tile sanitary cove base and all corners as required by layout.

F. At all wainscot tile applications, include 3”x6” bullnose ceramic tile (on 6” side) or Schluter Jolly at top course of tile. Wainscot typically +/-5’-4” A.F.F. unless otherwise noted. Include both left and right corners as required by layout.

G. In both full and wainscot height tile applications, 3”x6” bullnose tile (on 3” side) or Schluter Jolly shall be used along all vertical outside corners.

H. If porcelain floor tile type is not specified or intended to match existing, provide and install 12"x24" format tile from Dal-Tile’s Theoretical / Theoretical Bold collection or tile of equal value. Pattern and Colors to be approved/provided by architect during submission phase.

I. Floor tile shall be non-slip with a dynamic coefficient of friction not less than 0.42.

J. All mortar mixtures for tile work shall be as recommended by the Tile Council of North America and the American National Standards Institute, Inc.

K. Caulking and expansion joints – one part silicone rubber.

L. Marble Thresholds shall be Alabama White, Class “B” or better, polished. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16” above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2” or less above adjacent floor surface.

2.02 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following products that may be incorporated into the Work include, but are not limited to, the following:

    a. Bostik, Inc.; Hydroment Blacktop 90210
    b. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane
    c. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane
    d. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh

2.03 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. USG Corporation; DUROCK Cement Board.
    b. C-Cure; C-Cure Board 990.
    c. Custom Building Products; Wonderboard.
    d. FinPan, Inc.; ProTEC Concrete Backer Board.

2. Thickness: 1/4”, 1/2" or 5/8” as indicated on the Drawings.

B. Fiber-Cement Backer Board: ASTM C 1288.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following

a. CertainTeed Corporation; FiberCement – Underlayment/ Backerboard.
b. James Hardie Building Products, Inc. – Hardiebacker 1/4”.

2. Thickness: 1/4” or 1/2" as indicated on the Drawings.

2.04 SETTING MATERIALS

A. Dry-Set Portland Cement Mortar (Thinset): ANSI A118.1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik, Inc.
b. Custom Building Products
c. Laticrete International, Inc.
d. MAPEI Corporation

2.05 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. MAPEI Corporation
b. Ardex Americas
c. Bostik, Inc.
d. Custom Building Products
e. Laticrete International, Inc.

B. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. MAPEI Corporation
b. Bostik, Inc.
c. Custom Building Products
d. Laticrete International, Inc.

2.06 ADDITIONAL MATERIAL

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated and store them where directed by the Owner.

PART 3 – EXECUTION

3.01 INSPECTION

A. Before proceeding with any tiling work, make sure that all sleeves and flashing for various pipes have been installed and that pipes have been run and tested; that conduit which are to be covered are in position and have been approved; and that the locations of all other work required by other trades to be set in the walls or floors are their correct locations, height, or projections. Immediately report any errors or discrepancies to the Architect.

B. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Spaces in which tile is to be set shall be closed to traffic and other work. Spaces shall remain closed until tile is firmly set. Protect tile from damage until work is accepted by the Architect.

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 WORKMANSHIP

A. Internal angles shall be butted and external angles shall be bullnosed using integral combination tile.

B. At door trim, the tile of all base members shall be bullnosed back to the trim with integral combination tile. No block angles will be allowed.

C. Provide manufacturer’s standard trim shapes where necessary to eliminate exposed tile edges.

D. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

E. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

F. All base tile required in any room shall be set before work on the floor is started. The tiles shall be brought to true lines and levels and with joints flush. Base shall stop tile at opening flush with trim.

G. Installation of tile work shall be performed in manner conforming with the best current practice in the industry.

3.04 SETTING

A. Thin-set bed for floor tile shall be in conformance with ANSI 108.5. Surfaces shall be clean, smooth, and level.

B. All tile shall be set in strict accordance with the recommendations of the approved tile manufacturers, the Tile Council of North America, Inc., and the American National Standards Institute, Inc.

3.05 INSTALLATION

A. General:

1. Press individual tile onto setting bed using extreme care to maintain accurate joint alignment and spacing.

2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

3. Tile work shall be laid out in such manner to avoid excessive cutting. No cuts smaller than one-half size shall be made. All areas of tile shall be centered and balances. All cuts shall be made on the outer edge of the field.

4. Smooth all cut edges with a carborundum stone and install no tile with jagged or flaked edges.

5. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

6. The splitting of tile is expressly prohibited.

7. Make corners of all tile flush and level with corners of adjacent tile, with due allowance to warpage tolerances.

8. Keep all joint lines straight and of even width, including miters. All joints shall be uniform, not more than ¼”.

9. Finish floor areas level and plumb with 1/8” of true plan in 8 feet.

10. The finished tile work shall be clean and free of tiles that are pitted, chipped, cracked or scratched.

11. Provide manufacturer’s standard trim shapes where necessary to eliminate exposed tile edges.

12. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

B. Recommended Installation Standards (as per Tile Council of North America):

1. Floors:

    a. Concrete Subfloor:

        F112-90 – Cement Mortar, Bonded
        F113-90 – Dry-Set Mortar or Latex-Portland
        F122-90 – Thin-Set (on waterproof membrane)

2. Walls:

    a. Interior Walls (Solid Backing):

        W222-90 – One Coat Method
        W242-90 – Gypsum Board, Organic Adhesive

C. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

D. Joint Widths: By manufacturers recommendations, otherwise install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch.
2. Quarry Tile: 3/8 inch.
3. Glazed Wall Tile: 1/16 inch.
4. Porcelain Tile: 1/8 inch.

E. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

F. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

G. Metal Edge Strips: Install at locations indicated.

3.06 CUTTING, FITTING, AND DRILLING

A. Do all necessary cutting, fitting, etc. of tile work wherever required in connection with this work as may be necessary to overcome an inaccuracies and to make the materials properly fit and conform to the conditions of the building, and as may be required for other mechanics in connection with their work, and to finish up after them, all in a neat and accurate manner as approved.

B. All intersections and returns shall be neatly formed. All cutting and drilling shall be neatly done without marring the surfaces. Around outlets, piping, fittings or fixtures, etc., the tile shall be fitted close so that the usual plates, collars, or coverings shall overlap the tile.

3.07 GROUTING AND CLEANING

A. As soon as the setting beds have sufficiently set, tile, and floors shall be thoroughly cleaned of all dirt, mortar, and foreign matter by washing and scrubbing with clean water and then all joints in quarry tile shall be grouted with gray Portland Cement and fine white sand mixed with clean water, forced into joints and finished flush and true. All traces of cement shall be wiped for the surface of tile before hardening. Grout materials shall conform to ANSI A118.1.

B. The floor tile grout shall be spread uniformly over the floor and thoroughly worked into the joints, filling them solidly. After grouting has been completed, all surplus grout shall be removed and the floors left clean.

C. Grout shall be colored by the addition of approved mineral coloring pigment where directed by the Architect.

D. Grout for tile shall be mixed with an integral waterproofing compound.

E. The use of acid solutions is prohibited. Any tile work and other work damaged by the use of a strong cleaning agent shall be replaced at the Contractor's expense.

F. All work of other Contractors, which may have become soiled during the operation of any of the work covered under this Contract, shall be properly cleaned off without damage to such work and left in a clean, neat, and perfect condition, as approved by the Architect.

3.08 PROTECTION AND REPLACEMENT

A. All tile work shall be adequately protected by approved means and all finished tiled areas shall be closed to all traffic or work by an approved barrier. Protection and barrier shall be removed when directed without causing any damage.

B. Protect all work of other trades and contracts from damage caused by work under this section and make good all such damage to the satisfaction of the Architect and without cost to the Owner.

C. Any work of other trades damaged or injured by the removing of any rejected work and the setting on new work or by a trimming, cutting, fitting, drilling, etc., or by cleaning or other cause shall be made at the Contractor's expense.

D. Include cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended. All methods and materials to be per tile manufacturer's recommendations.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 095000 – ACOUSTICAL CEILING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Conditions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

1.02 SUMMARY

A. Ceiling Types:

1. The extent of each type of acoustic ceiling is shown on the drawings and in schedules.
2. The types of acoustical ceilings required are as follows:

    a. Mineral fiber acoustic panels in exposed grid suspension system.

B. Related Work:

1. Section 092900 – Gypsum Wall Board
2. Section 099000 – Painting

C. Related Work in Other Contracts:

1. Heating, Ventilating, and Air Conditioning Work:

    a. Grilles, diffusers, and similar air distribution components installed in acoustic ceiling system. Refer to Division 23.

2. Electric Work:

    a. Lighting fixtures, smoke detection systems, sound systems, and similar electrical components installed in acoustic ceiling system. Refer to Division 26, 27 & 28.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material
10. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
11. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
12. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
13. ASTM E 1264 Classification for Acoustical Ceiling Products

B. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

C. NFPA 70 National Electrical Code

D. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

E. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

F. International Code Council-Evaluation Services Report - Seismic Engineer Report

1. ESR 1308 - Armstrong Suspension Systems

G. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report

1. 0244 - Armstrong Single Span Suspension System

1.04 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 - Submissions, and as modified below.

B. Product Data:

1. Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

C. Samples:

1. Architect's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the contractor.

2. Submit samples of the following: (Only when submitting equivalents or substitutions)

a. Exposed grids: Submit three 8" long samples of each type exposed runner.
b. Moldings: Submit three 8" long samples of each type required.
c. Acoustic units: Submit 3 sets of 6” x 6” square samples for each different acoustic unit required. Each set of samples shall show the full range of color and texture to be expected in the completed work.

D. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.

E. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

F. Maintenance Instructions:

1. Submit two copies of the manufacturer's recommendations for cleaning and refinishing each type of acoustic unit used in the work. Include precautions against materials and methods which may be detrimental to finishes and acoustic efficiency. Submit to Architect for transmittal to Owner.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

2. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory.

C. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

E. Installer Requirements:

1. Acceptable to manufacturer of primary acoustic materials.

1.06 DELIVERY AND STORAGE

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not install interior ceilings until space is enclosed and weatherproof and HVAC system is operational; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture equilibrium.

3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:

   a. Relative Humidity: 65-75%
   b. Uniform Temperature: 55-70ºF

1.08 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

   1. Acoustical Panels: Sagging and warping.
   2. Grid System: Rusting and manufacturer's defects.

B. Warranty Period:

   1. Acoustical panels: One (1) year from date of substantial completion.
   2. Cirrus: Ten (10) years from date of substantial completion.
   3. Grid: Ten (10) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.09 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

   1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.

   2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 SUSPENSION SYSTEMS

A. Quality Standard:

   1. Provide direct hung suspension system complying with ASTM C 635 for the following structural classifications:

      a. Intermediate duty, unless otherwise indicated.

B. Manufacturers:

   1. Provide suspension systems for acoustic ceilings as produced by one of the following:

a. Armstrong World Industries, Inc.
b. Rockfon North America
c. Certainteed Architectural
d. USG Corporation

C. Hangers:

1. Provide hangers as recommended by suspension system manufacturer to comply with specified structural classification.

a. If suspension system manufacturer does not indicate hanger recommendation, provide not less than 9 gauge galvanized, soft annealed, mild steel wire.

2. Where hanger wires cannot be directly wire-tied to structural or intermediate framing members, provide attachment devices designed for the type of construction used in the work and with a carrying capacity of not less than 5 times the design loads involved.

D. Edge Moldings:

1. Provide manufacturer's standard angle or channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish.

E. Exposed Grid Suspension System:

1. Provide Class A fire rated single web steel main runners, matching interlocking cross runners, adapters, and accessories with exposed cross runners coped to lay flush with main runners.

2. Finish: Smooth, matte white baked enamel.

F. Protective Coatings and Finish:

1. Provide manufacturer's standard coatings and finishes for normal use environments (ASTM C 635), except as noted.

2. In toilet rooms, provide protective coatings and finishes complying with High Humidity Test Requirements (ASTM C 635).

2.02 ACOUSTIC CEILING UNITS

A. Manufacturers:

1. For convenience, details and specifications have been based on products indicated by the following manufacturers:

a. Mineral fiber acoustic panels and tiles: Armstrong World Industries, Inc.

2. Other manufacturers offering mineral fiber acoustic panels and tiles complying with the requirements include:

a. Certainteed Architectural
b. USG Corporation

B. Mineral Fiber Acoustic Panels:

1. Provide Class A Finish units, not less than 5/8" thick, with flame spread of 25 or less; smoke developed index rating of less than 450; complying with performance requirements and

physical characteristics of the specified panels indicated in the construction documents (ASTM E84, NFPA 255, UL 793).

2. Classrooms and meeting rooms shall be provided with an acoustic ceiling tile with a minimum NRC rating of 0.65.

3. Food Storage, food preparation, and food serving areas, toilet rooms, showers and similar areas shall receive non-absorbent, impervious tile to facilitate cleaning as specified in the construction documents.

2.03 ACCESSORIES

A. Hold Down Clips:

1. Provide manufacturer's standard spring steel clips spaced as recommended by said manufacturer in the following spaces:

a. All gymnasiums.
b. All recreation rooms.
c. All Locker rooms including toilet rooms within.
d. All High School corridors.
e. All Middle School corridors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION OF SUSPENSION SYSTEMS

A. General:

1. Coordination: Prior to start of acoustic ceiling work, consult other trades and contractors involved to determine areas of potential interference. Do not start installation of suspension systems until interferences have been resolved.

2. Provide framed openings around all sides of openings receiving items set in or attached to ceilings.

3. Install suspension systems in accordance with manufacturer's printed instructions and to comply with the requirements of ASTM C 636.

B. Hangers:

1. Space not more than 6" from each end and not more than 4' o.c. between ends of members to be supported. Provide additional hangers for support of light fixtures and other items to be

supported by the ceiling suspension system including clips to securely fasten all framing members (used to support fixtures) to each other to prevent eccentric deflection or rotation of supporting runners.

C. Moldings:

1. Provide edge moldings where ceilings meet walls, partitions, and other vertical elements.

2. Corners: Miter cut inside and outside corners or install corner caps.

D. Runners:

1. Support main runners directly from hangers; do not bear on walls or partitions. Space main runners to support acoustic panels and other work resting in or on the ceiling, as required to comply with specified performance requirements. Interlock cross-runners with either main runners or with cross-runners structurally classified as main runners. Install moldings with exposed leg in same plane as bottom flange of runners.

E. Where ceiling suspension systems are attached directly to the bottom chord of joists, ceiling extensions (either an extended bottom chord element or a separate unit, to suit manufacturer's standards, or sufficient strength to support ceiling construction) shall be provided. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.

3.04 INSTALLATION OF ACOUSTIC CEILING UNITS

A. General:

1. Do not install acoustic ceilings until installation areas meet the following requirements:

a. Exterior openings have been closed and roofs are weathertight.
b. Mechanical, electrical, and other work above ceilings has been completed.
c. Wet work has been installed.
d. Temperature and relative humidity have reached levels which comply with acoustic material manufacturer's recommendations for the units to be used in the work and are acceptable to the installer.

2. Install materials in accordance with manufacturer's printed instructions and other recommendations applicable to the work.

3. Balance border areas to avoid units of less than 1/2 unit width wherever possible. Wherever ceiling area is a multiple of full size acoustic units used in the work, balance alignment to be square and true and install only full size units for entire ceiling including borders.

B. Installation of Acoustic Panels in Exposed Grid Suspension Systems:

1. Install square edge panels to rest on flanges of grid tees with border units supported by moldings.

a. Field cut border units square and support on wall moldings.

2. Provide hold-down clips for panel areas where indicated; omit clips where access areas are shown.

a. Install 2 clips per panel at center of opposite sides of long dimension.
b. Install 4 clips per panel at midpoint of each side.

3.05 CLEAN UP AND PROTECTION

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace units and members which are damaged or cannot be cleaned.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 095133 – ACOUSTICAL METAL CEILING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Conditions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

1.02 SUMMARY

A. Ceiling Types:

1. The extent of each type of acoustical metal ceiling is shown on the drawings and in schedules.

2. The types of metal ceilings required are as follows:

a. METALWORKS series as indicated on the drawings and in schedules as manufactured and supplied by Armstrong World Industries, Inc., or approved equal.

B. Related Work in Other Sections:

1. Section 092900 – Gypsum Wall Board
2. Section 099000 – Painting

C. Related Work in Other Contracts:

1. Heating, Ventilating, and Air Conditioning Work:

a. Grilles, diffusers, and similar air distribution components installed in acoustic ceiling system. Refer to Division 23.

2. Electric Work:

a. Lighting fixtures, smoke detection systems, sound systems, and similar electrical components installed in acoustic ceiling system. Refer to Division 26, 27 & 28.

D. System Description:

1. Ceiling system shall be comprised of a continuous pattern of interlocking linear metal beams attached to a T-bar carrier system that is suspended from the purlin structure.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material
10. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
11. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
12. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
13. ASTM E 1264 Classification for Acoustical Ceiling Products

B. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

C. NFPA 70 National Electrical Code

D. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

E. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

F. International Code Council-Evaluation Services Report - Seismic Engineer Report

1. ESR 1308 - Armstrong Suspension Systems

G. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report

1. 0244 - Armstrong Single Span Suspension System

1.04 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 - Submissions, and as modified below.

B. Product Data:

1. Submit manufacturer's technical data for each type of metal ceiling system required.

C. Samples:

1. Architect's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the contractor.

2. Submit samples of the following:

a. Submit descriptive literature along with installation recommendations and practices.

b. Submit a 12" x 12" samples and color chart indicating the required system finish for selection by the Architect.

c. Submit literature pertaining to sound absorption coefficients.

D. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.

E. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

F. Maintenance Instructions:

1. Submit two copies of the manufacturer's recommendations for cleaning and refinishing each type of metal unit used in the work. Include precautions against materials and methods that may be detrimental to finishes and acoustic efficiency. Submit to Architect for transmittal to Owner.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

C. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

E. Installer Requirements:

1. Acceptable to manufacturer of primary acoustic materials.

1.06 DELIVERY AND STORAGE:

A. Deliver metal ceiling materials to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not install interior ceilings until space is enclosed and weatherproof and HVAC system is operational; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture equilibrium.

3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:

    a. Relative Humidity: 65-75%
    b. Uniform Temperature: 55-70ºF

1.08 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

    1. Acoustical Panels: Sagging and warping.
    2. Grid System: Rusting and manufacturer's defects.

B. Warranty Period:

    1. Acoustical metal panels: One (1) year from date of substantial completion.
    2. Grid: Ten (10) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.09 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

    1. Acoustical Metal Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.

    2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 SUSPENSION SYSTEMS:

A. Quality Standard:

    1. Provide direct hung suspension system complying with ASTM C 635 for the following structural classifications:

        a. Intermediate duty, unless otherwise indicated.

B. Manufacturers:

1. Provide suspension systems for metal ceilings as produced by one of the following:

a. Armstrong World Industries, Inc.
b. Rockfon North America
c. Certainteed Architectural
d. USG Corporation

C. Hangers:

1. Provide hangers spaced as recommended by suspension system manufacturer with hanger wires to comply with specified structural classification.

a. If suspension system manufacturer does not indicate hanger recommendation, provide not less than 9 gauge galvanized, soft annealed, mild steel wire, spaced at 4'-0" maximum.

2. Where hanger wires cannot be directly wire-tied to structural or intermediate framing members, provide attachment devices designed for the type of construction used in the work and with a carrying capacity of not less than 5 times the design loads involved.

D. Edge Moldings:

1. Provide manufacturer's standard angle or channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish or as indicated on the Drawings.

E. Exposed Grid Suspension System:

1. Provide Class A fire rated single web steel main runners, matching interlocking cross runners, adapters, and accessories with exposed cross runners coped to lay flush with main runners.

2. Finish: Smooth, matte white baked enamel or as indicated on the Drawings.

F. Protective Coatings and Finish:

1. Provide manufacturer's standard coatings and finishes for normal use environments (ASTM C 635), except as noted.

G. Integrated Accessories:

1. Acoustical Insulation:

a. Insulation shall be a blanket type, unfaced, and "midnight" black in color.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION OF SUSPENSION SYSTEMS:

A. General:

1. Coordination: Prior to start of metal ceiling work, consult other trades and contractors involved to determine areas of potential interference. Do not start installation of suspension systems until interferences have been resolved.

2. Provide framed openings around all sides of openings receiving items set in or attached to ceilings.

3. Install suspension systems in accordance with manufacturer's printed instructions and to comply with the requirements of ASTM C 636.

B. Hangers:

1. Space not more than 6" from each end and not more than 4' o.c. between ends of members to be supported. Provide additional hangers for support of light fixtures and other items to be supported by the ceiling suspension system including clips to securely fasten all framing members (used to support fixtures) to each other to prevent eccentric deflection or rotation of supporting runners.

C. Moldings:

1. Provide edge moldings where ceilings meet walls, partitions, and other vertical elements.

2. Corners: Miter cut inside and outside corners or install corner caps.

D. Carrier Components:

1. Main carriers shall be suspended on 4-ft. centers and shall be suspended by appropriate hanger wire also on 4-ft. centers. Consecutive main carriers shall be joined by means of an integral splice, which requires no pop riveting or screw attachment.

2. Install appropriate cross tees or spacer bars, which are spaced on 4' to 6' centers, to stabilize the main carrier component.

3. Install a cross tee carrier, flat carrier as required.

E. Runners:

1. Support main runners directly from hangers; do not bear on walls or partitions. Space main runners to support acoustic panels and other work resting in or on the ceiling, as required to comply with specified performance requirements. Interlock cross-runners with either main runners or with cross-runners structurally classified as main runners. Install moldings with exposed leg in same plane as bottom flange of runners.

F. Where ceiling suspension systems are attached directly to the bottom chord of joists, ceiling extensions (either an extended bottom chord element or a separate unit, to suit manufacturer’s standards, or sufficient strength to support ceiling construction) shall be provided. Extend ends to

within 1/2” of finished wall surface unless otherwise indicated.

G. Integrated Accessories:

1. Insulation: Insulation is to be installed at time when each metal panel is being installed.

3.04 INSTALLATION OF METAL CEILING UNITS:

A. General:

1. Do not install metal ceilings until installation areas meet the following requirements:

a. Exterior openings have been closed and roofs are weathertight.
b. Mechanical, electrical, and other work above ceilings has been completed.
c. Wet work has been installed.
d. Temperature and relative humidity have reached levels that comply with material system manufacturer's recommendations for the units to be used in the work and are acceptable to the installer.

2. Install materials in accordance with manufacturer's printed instructions and other recommendations applicable to the work.

3. Balance border areas to avoid units of less than 1/2 unit width wherever possible. Wherever ceiling area is a multiple of full size metal units used in the work, balance alignment to be square and true and install only full size units for entire ceiling including borders.

3.05 CLEAN UP AND PROTECTION:

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace units and members which are damaged or cannot be cleaned.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 095426 – SUSPENDED WOOD CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Conditions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

1.02 SUMMARY

A. Ceiling Types:

1. The extent of each type of wood ceiling is shown on the drawings and in schedules.

2. The types of wood ceilings required are as follows:

a. WOODWORKS series as indicated on the drawings and in schedules as manufactured and supplied by Armstrong World Industries, Inc., or approved equal.

B. Related Work in Other Sections:

1. Section 092900 – Gypsum Wall Board
2. Section 099000 – Painting

C. Related Work in Other Contracts:

1. Heating, Ventilating, and Air Conditioning Work:

a. Grilles, diffusers, and similar air distribution components installed in acoustic ceiling system. Refer to Division 23.

2. Electric Work:

a. Lighting fixtures, smoke detection systems, sound systems, and similar electrical components installed in acoustic ceiling system. Refer to Division 26, 27 & 28.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

8. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
9. ASTM E 1264 Classification for Acoustical Ceiling Products

B. Hardwood Plywood & Veneer Association (HPVA)

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

G. International Code Council-Evaluation Services Report - Seismic Engineer Report

1. ESR 1308 - Armstrong T-Bar or Dimensional Suspension

H. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report

1. 0244 - Armstrong Single Span Suspension System

1.04 SUBMISSIONS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit manufacturer's technical data for each type of wood ceiling system required.

C. Samples:

1. Architect's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the contractor.

2. Submit samples of the following:

a. Submit descriptive literature along with installation recommendations and practices.
b. Submit a 12" x 12" samples and color chart indicating the required system finish for selection by the Architect.
c. Submit literature pertaining to sound absorption coefficients.

D. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.

E. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

F. Maintenance Instructions:

1. Submit two copies of the manufacturer's recommendations for cleaning and refinishing each

type of wood unit used in the work. Include precautions against materials and methods that may be detrimental to finishes and acoustic efficiency. Submit to Architect for transmittal to Owner.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested by HPVA (Hardwood Plywood and Veneer Association) under the test standard ASTM E-84 tunnel test and complying with ASTM E 1264 for Class A products.

a. Flame Spread: 25 or less
b. Smoke Developed: 50 or less

C. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

D. Woodworks Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

E. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.06 DELIVERY AND STORAGE:

A. Store the wood veneer ceiling panels in a dry interior location in their cartons prior to installation to avoid damage. Store the ceiling panel cartons in a flat, horizontal position. Do not remove the protectors between the panels until installation.

B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Do not expose the wood veneer ceiling panels to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not install interior ceilings until space is enclosed and weatherproof and HVAC system is operational; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

2. Prior to installation, the wood veneer ceiling materials are required to reach room temperature and have stabilized moisture content for a minimum of 72 hours.

3. As interior finish products, the wood veneer panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.08 WARRANTY

A. Wood Veneer Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

1. Ceiling Panels: Defects in materials or factory workmanship.
2. Grid System: Rusting and manufacturer's defects.

B. Warranty Period:

1. Wood veneer panels: One (1) year from date of installation.
2. Grid: One (1) year from date of installation.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.09 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 SUSPENSION SYSTEMS:

A. Quality Standard:

1. Provide direct hung suspension system complying with ASTM C 635 for the following structural classifications:

a. Heavy duty, unless otherwise indicated.

B. Manufacturers:

1. Provide suspension systems for wood ceilings as produced by one of the following:

a. Armstrong World Industries, Inc.
b. Rockfon North America
c. Certainteed Architectural
d. USG Corporation

C. Hangers:

1. Provide hangers spaced as recommended by suspension system manufacturer with hanger wires to comply with specified structural classification.

a. If suspension system manufacturer does not indicate hanger recommendation, provide not less than 9 gauge galvanized, soft annealed, mild steel wire, spaced at 4'-0" maximum.

2. Where hanger wires cannot be directly wire-tied to structural or intermediate framing members, provide attachment devices designed for the type of construction used in the work and with a carrying capacity of not less than 5 times the design loads involved.

D. Edge Moldings:

1. Provide manufacturer's standard angle or channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish or as indicated on the Drawings.

E. Exposed Grid Suspension System:

1. Provide Class A fire rated single web steel main runners, matching interlocking cross runners, adapters, and accessories with exposed cross runners coped to lay flush with main runners.

2. Finish: Smooth, matte white baked enamel or as indicated on the Drawings.

F. Protective Coatings and Finish:

1. Provide manufacturer's standard coatings and finishes for normal use environments (ASTM C 635), except as noted.

G. Integrated Accessories:

1. Acoustical Insulation:

a. Insulation shall be a blanket type, unfaced, and "midnight" black in color.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

B. Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION OF SUSPENSION SYSTEMS:

A. General:

1. Coordination: Prior to start of wood ceiling work, consult other trades and contractors involved to determine areas of potential interference. Do not start installation of suspension systems until interferences have been resolved.

2. Provide framed openings around all sides of openings receiving items set in or attached to ceilings.

3. Install suspension systems in accordance with manufacturer's printed instructions and to comply with the requirements of ASTM C 636.

B. Hangers:

1. Space not more than 6" from each end and not more than 4' o.c. between ends of members to be supported. Provide additional hangers for support of light fixtures and other items to be supported by the ceiling suspension system including clips to securely fasten all framing members (used to support fixtures) to each other to prevent eccentric deflection or rotation of supporting runners.

C. Moldings:

1. Provide edge moldings where ceilings meet walls, partitions, and other vertical elements.

2. Corners: Miter cut inside and outside corners or install corner caps.

D. Carrier Components:

1. Main carriers shall be suspended on 4-ft. centers and shall be suspended by appropriate hanger wire also on 4-ft. centers. Consecutive main carriers shall be joined by means of an integral splice, which requires no pop riveting or screw attachment.

2. Install appropriate cross tees or spacer bars, which are spaced on 4' to 6' centers, to stabilize the main carrier component.

3. Install a cross tee carrier, flat carrier as required.

E. Runners:

1. Support main runners directly from hangers; do not bear on walls or partitions. Space main runners to support acoustic panels and other work resting in or on the ceiling, as required to comply with specified performance requirements. Interlock cross-runners with either main runners or with cross-runners structurally classified as main runners. Install moldings with exposed leg in same plane as bottom flange of runners.

F. Where ceiling suspension systems are attached directly to the bottom chord of joists, ceiling extensions (either an extended bottom chord element or a separate unit, to suit manufacturer’s standards, or sufficient strength to support ceiling construction) shall be provided. Extend ends to within 1/2” of finished wall surface unless otherwise indicated.

G. Integrated Accessories:

1. Insulation: Insulation is to be installed at time when each wood panel is being installed.

3.04 INSTALLATION OF WOOD CEILING UNITS:

A. General:

1. Do not install wood ceilings until installation areas meet the following requirements:

a. Exterior openings have been closed and roofs are weathertight.
b. Mechanical, electrical, and other work above ceilings has been completed.
c. Wet work has been installed.
d. Temperature and relative humidity have reached levels that comply with material system manufacturer's recommendations for the units to be used in the work and are acceptable to the installer.

2. Install materials in accordance with manufacturer's printed instructions and other recommendations applicable to the work.

3. Balance border areas to avoid units of less than 1/2 unit width wherever possible. Wherever ceiling area is a multiple of full size wood units used in the work, balance alignment to be square and true and install only full size units for entire ceiling including borders.

3.05 CLEAN UP AND PROTECTION:

A. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096466.11 – WOOD ATHLETIC FLOORING (Conner "Duracushion III")

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related work specified under other sections:

1. Concrete Subfloors – Section 033000 – Cast-in-Place Concrete

   a. The General Contractor shall furnish and install the concrete subfloors depressing the slab sufficiently to accommodate the floor system. The slab shall be steel troweled and finished smooth to a tolerance of 1/8" in any 10' radius by the General Contractor. High spots shall be ground level, and low spots filled in with approved leveling compound by the General Contractor to the full approval of the installer (Flooring Contractor).

   b. Slab Depressions: 3-1/8" for 25/32" flooring and 3/8" pad.
   3-3/8" for 25/32" flooring and 5/8" pad.

2. Membrane Waterproofing – Section 072600 – Vapor Retarders

   a. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on earth side of below grade walls by the General Contractor using suitable type membrane. Below grade slabs or in areas with a hydrostatic head shall be adequately waterproofed beneath the slab on earth side of walls using 1/8" pre-molded membrane equal to W.R. Meadows, Inc., Elgin, Illinois.

3. Thresholds – Section 087100 – Door Hardware

4. Game Standard Inserts – Section 116600 – Athletic Equipment

B. Work included: Furnish labor, materials, tools, and equipment necessary or required to perform and complete the installation of wood athletic flooring as indicated on the drawings including, but not limited to:

1. New premolded multi-ply waterproof membrane with plastic core.
2. Remove and replace game plates as indicated on drawings.
3. New volleyball sleeves, footings, and game plates.
4. New hardwood flooring system.
5. Sanding and sealing.
6. Finish application and painting of new game lines.
7. New cove base.

1.02 REFERENCES

A. MFMA - Maple Flooring Manufacturers Association.

1.03 QUALITY ASSURANCE

A. Manufacturer

1. Manufacturer of resilient flooring shall be a firm specializing in manufacturing products specified in this section.

2. Manufacturer of flooring and subfloor components must be ISO 14001:2015 Certified.

3. Basis of design shall be “Duracushion III” sports floor system as provided by Connor Sports, www.connorfloor.com, (800-833-7144).

4. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

B. Installer (Flooring Contractor)

1. The complete installation of the flooring system, as described in the scope of these specifications, shall be carried out by an experienced installer (Flooring Contractor), and the work shall be performed in accordance with most recent installation instructions of the manufacturer.

2. Installer (Flooring Contractor) shall be liable for all matters related to installation for a period of one year after the floor has been substantially installed and completed.

3. Throughout the progress of the work of this section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and direct all work performed under this section.

4. Flooring shall be delivered to the premises a minimum of seven days before installation commences, or as required for acclimation.

5. All flooring bundles should be broken and loosely piled to acclimate the flooring to environmental conditions in the building.

C. Performance Testing

1. Floor system shall have been independently evaluated according to established performance standards for the athletic flooring industry.

2. Compliance of athletic floor standard(s) for specified system as provided by Connor Sports at www.connorsports.com

1.04 SUBMISSIONS

A. General:

1. Comply with the requirements of Section 013300 – Submittal Procedures.

2. Submit Connor Duracushion III specification sheets.

3. Submit manufacturer's technical product data and installation instructions for flooring system accessories, vapor barrier, and cove base to be furnished.

4. Submit certification that the materials furnished will meet specifications for grade, quality, dryness, and treatment.

B. Samples:

1. Submit three samples of each material utilized.

2. Submit one sample of specified system.

C. Maintenance Literature:

1. Upon completion of floor installation, send to owner, attendants or individuals in charge and responsible for the upkeep of the building a CARE CARD. This card spells out care and maintenance instructions including temperature and humidity ranges for areas where flooring is installed.

1.05 JOB CONDITIONS

A. Conditioning: Do not proceed with installation of wood flooring until spaces have been enclosed and are at approximate humidity condition planned for occupancy. Condition wood for five (5) days prior to start of installation by placing in spaces to receive flooring and maintaining ambient temperature between 60° to 80°F before, during, and after installation.

B. The wood flooring specified herein shall not be installed until all masonry, painting, plaster, tile, marble and terrazzo work is completed, and overhead mechanical trades and painters have finished in the wood floor areas. The building shall be enclosed and weathertight.

C. The concrete subfloor shall be determined dry by industry standard testing procedures, free of foreign materials and turned over to the installer (Flooring Contractor) broom clean. Moderate room temperature of 65 degrees or more shall be maintained a week preceding and throughout the duration of the work. Humidity conditions within the building shall approximate the humidity conditions that will prevail when the building is occupied.

D. Permanent heat, light and ventilation shall be installed and operating during and after installation, maintaining a range of temperature and humidity compatible with the expected low and high moisture content of the flooring. The wood moisture content range is determined by the flooring contactor based on the facility's mechanical controls and/or geographical location.

E. Flooring must be stored in a dry, well-ventilated area, not in contact with masonry, to acclimate to building conditions and shall be installed at moisture content compatible with the normally expected environmental range of temperature and relative humidity achieved while the facility is occupied.

F. General Contractor shall lock floor area after floor is finished to allow proper cure time. If general contractor or owner requires use of gym after proper cure time, he shall protect the floor by covering with non-marring Kraft paper or red rosin paper with taped joints until acceptance by owner of complete gymnasium floor.

G. Working conditions as described above shall be followed. Variations and substitutions shall be submitted for approval to the architect who shall advise Connor of the same.

1.06 TREATING

A. Wood flooring shall be treated with Woodlife. Woodlife is a clear, penetrating, water repellent wood preservative that protects against mold, mildew, staining, and decay fungi, and serves as a deterrent to termites and other insects.

1.07 HUMIDITY CONTROL

A. Since all wood flooring will expand and contract as relative humidity varies, it is important to minimize extremes between low and high. Hardwood flooring is manufactured at moisture content most compatible with a 35%-50% relative humidity range. Geographical regions and available mechanicals determine the typical range of temperature and humidity for each facility. Maintaining a 15% fluctuation between highest and lowest average indoor relative humidity provides limited shrinkage and growth. Facility managers should make use of available HVAC systems to prevent excessive tightening and shrinkage of flooring.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Materials shall not be delivered or installed until the Contractor is satisfied that the environmental conditions in the storage area and areas to receive new floor are in accordance with manufacturer's requirements.

2. Materials shall be delivered in their original, unopened packages or containers.

B. Storage:

1. Store all materials in a single location approved by the Owner. Storage area is to be kept neat and clean. Any damage to storage area or its surroundings occurring during its use for storage shall be repaired to its original state (Architect's acceptance required). Remove all soiled or used rags, waste, and trash from the building every night and take every precaution to avoid damage of fire.

C. Protection:

1. Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.

D. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.09 WARRANTY

A. Upon completion of the work of this section, and as a condition of its acceptance, deliver to the Owner a written guarantee, signed by the Contractor and installing subcontractor, agreeing to repair or replace all defective work resulting from deficiencies in labor and/or material and all other work damaged in the event of failure of the system from any cause other than a structural failure of building or malicious damage, for a period of one year, as outlined in Section 017000: Contract Closeout, without additional cost to the Owner.

B. The above parties further agree to repair or replace all defective work at no additional cost to the Owner during the term of the guarantee.

PART 2 - PRODUCTS

2.01 GENERAL

A. Design is based on use of ‘Duracushion III' manufactured by Connor AGA, and the terminology used may include reference to that manufacturer's or to other manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

B. Products used shall be those upon which design is based or shall be equal products approved in advance by the Architect.

2.02 MATERIALS

A. Under Slab Vapor Barrier:

1. Premolded multi-ply membrane, W.R. Meadows premolded membrane with plastic core or approved equal.

B. Vapor Barrier:

1. 6-mil polyethylene.

C. Resilient Pads:

1. Connor Duracushion pads: 3/8" x 2 1/4" x 3", spaced 12" o.c. maximum.

D. Sleepers:

1. Nominal 2” x 3” x 4’ Spruce, Fir, Pine or Hemlock dip treated with Woodlife for a minimum of 3 minutes immersion with 5 pads attached 12” on center.

E. Subfloor:

1. 15/32” APA rated plywood sheathing, Exposure 1.

F. Flooring:

1. 25/32" x 2 1/4" First Grade, Northern Hard Maple Flooring, TGEM, MFMA Grade marked and stamped as manufactured by Connor Sports, Amasa, MI.

2. Treating: Flooring shall be treated with Woodlife F preservative

G. Fasteners:

1. Flooring - 2” barbed cleats or coated staples.

2. Subfloor - 1-1/2” coated staples

H. Finish Materials:

1. Acceptable Manufacturer: Bona US, which is located at: 24 Inverness Place E. Suite 100; Englewood, CO 80112; ASD Toll Free Tel: 800-872-5515; Tel: 303-371-1411; Fax: 303-307-5029; Web: https://www.bona.com.

   a. Bona Sport Seal (1) coat; as manufactured by Bona US or Architect approved equal.
   b. Bona Sport Poly 275 (2) coats; as manufactured by Bona US or Architect approved equal

2. All materials to be V.O.C. compliant.

I. Game Lines:

1. Acceptable Manufacturer: Bona US, which is located at: 24 Inverness Place E. Suite 100; Englewood, CO 80112; ASD Toll Free Tel: 800-872-5515; Tel: 303-371-1411; Fax: 303-307-5029; Web: https://www.bona.com.

   a. Bona Courtlines; (2) coats min.; as manufactured by Bona US or Architect approved equal.

2. All materials to be V.O.C. compliant.

J. Wall Base:

1. 3” x 4”, heavy duty, molded, vented cove base with pre-molded outside corners.

PART 3 - EXECUTION

3.01 EXECUTION

A. Inspect concrete subfloors for proper tolerance and dryness and report any discrepancies to this Architect in writing.

B. All work required to put concrete subfloors in acceptable condition shall be the responsibility of the General Contractor.

C. Subfloor shall be broom cleaned by the Contractor.

3.02 INSTALLATION

A. Concrete Sub-Floor

1. Application of under slab premolded membrane shall be by the 6" dutch lap method, remove the polyfilm at the overlap, and then seal all laps with hot mop asphalt. Roll with pressure or walk in all laps to assure complete adhesion. The use of asbestos containing materials is expressly prohibited.

B. Subfloor

1. Cover concrete with poly, sealing and lapping joints a minimum of 6”.

2. Install sleepers at right angles to finish flooring 12” on center. Space ends 1/4” and offset joints 24” in adjacent rows. Provide 2” expansion voids at perimeter and at all vertical obstructions. Inspect sleepers to be sure that all pads bear on the concrete subfloor. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.

3. Attach plywood subfloor with 8’ edges parallel to and resting on sleepers. Set plywood in staggered brick pattern and offset plywood end joints by 1’ from sleeper end joints, 1/4" spacing at all edges. Fasten plywood to sleepers using 1-1/2” staples fastened 12” on center.

C. Maple Flooring

1. Install maple flooring by power nailing or stapling approximately 12” on center with end joints properly driven up.

2. If required, size joints between flooring strips to allow for intermediate expansion in accordance with local humidity conditions.

3. Provided 2” expansion voids at perimeter and at all vertical obstructions

3.03 FINISHING

A. Maple Flooring

1. Machine sand with coarse, medium, and fine paper to a smooth, even and uniform surface.

2. Remove sanding dust from entire surface by tack or vacuum.

3. Inspect entire area of floor to insure surface is acceptable for finishing, clean and completely free from sanding dust.

4. Apply approved sealer and approved finish per manufacturer's instructions.

5. Buff and clean floor between coats.

6. Games Lines: Apply game lines as indicated on drawings, between seal and first coat of finish. Lay out game lines in accordance with drawings. Layout of lines to be taped out and approved by Owner prior to painting. For size of courts and game lines, use current rules of association having jurisdiction. Apply game lines accurately, straight with sharp edges in colors selected by the Architect. Allow to dry overnight.

3.04 BASE INSTALLATION

A. Install vent cove base to walls with base cement or screws. Use pre-molded outside corners and mitered inside corners. Contractor shall assure that base vents do not get clogged with cement.

3.05 CLEANING

A. Remove excess and waste materials from the area of work.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096513 – RUBBER STAIR TREADS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 DESCRIPTION OF WORK

A. Provide new Resilient Rubber stair treads where shown on the drawings and as specified herein.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit manufacturer's technical data and installation instructions for each product submitted.
2. Include manufacturer's written instructions for recommended maintenance practices.

C. Samples:

1. For initial selection of color and pattern by Architect, submit digital samples showing manufacturer's full range of standard and custom colors and patterns available.
2. Submit samples of epoxy adhesive (waterproof) stabilized type as recommended by the manufacturer.

D. Maintenance Instructions:

1. Submit three copies of manufacturer's written instructions for recommended maintenance practices after installation.

E. Replacement Material:

1. Submit to the Owner at project site one carton of installed Rubber tread type and color for future replacement.

1.04 PRODUCT DELIVERY AND STORAGE

A. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors, patterns, and quality designations legible and intact.

B. Do not open containers or remove markings until materials are inspected and accepted.

C. Store and protect accepted materials in accordance with manufacturer's directions and recommendations.

D. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Tarkett, but not less than 55 deg F or more than 85 deg F.

1.05 PROJECT CONDITIONS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Maintain ambient temperatures within range recommended by Tarkett, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Until Substantial Completion, maintain ambient temperatures within range recommended by Tarkett, but not less than 55 deg F or more than 85 deg F.

PART 2 - PRODUCTS

2.01 RESILIENT SHEET FLOORING

A. Manufacturer:

Tarkett, Inc.
30000 Aurora Rd.
Solon, Ohio 44139
Web: www.tarkettna.com

Phone: (800) 899-8916
(440) 543-8916

2.02 RUBBER STAIR TREADS WITH INTEGRATED RISER

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett Tread with Integrated Riser - Type as indicated on Drawings.

B. Classification: ASTM F2169, as indicated on Drawings.

C. Size:

1. Length: Full width of stairs.
2. Width: 19"
3. 1.8” Square nose configuration.

D. Color and pattern: Unless otherwise specified, color shall be as selected by the Architect from manufacturer's full range of colors or custom colors. Pattern as indicated on Drawings.

E. Rubber stair tread shall be as manufactured by Tarkett or approved equal by the Architect.

F. Test Data:

1. Hardness (ASTM D2240): ≥ 85 Shore A
2. Resistance to Chemicals (ASTM F925): Passes
3. Resistance to Heat (ASTM F 1514): $\Delta E \leq 8$
4. Static Coefficient of Friction (ASTM D 2047): ≥ 0.5 SCOF
5. Flamability (ASTM E648, Critical Radiant Flux): Class 1 (≥ 0.45 W/cm2)
6. Limited Commercial Warranty: 5 years

G. The treads shall be homogeneously constructed of first-quality raw materials, and the color shall extend throughout the thickness of the tread.

H. All treads shall be free from objectionable odors, blisters, cracks, and other imperfections which will affect the serviceability of the treads.

I. The treads shall conform fully with ASTM F-2169 Standard Specification for Resilient Stair Treads, Type TS, Class 1 and 2, Group 1 and 2.

2.03 RUBBER STAIR TREADS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett Tread - Type as indicated on Drawings.

B. Classification: ASTM F2169, as indicated on Drawings.

C. Size:

1. Length: Full width of stairs.
2. Width: 19"
3. 1.8” Square nose configuration.

D. Color and pattern: Unless otherwise specified, color shall be as selected by the Architect from manufacturer's full range of colors or custom colors. Pattern as indicated on Drawings.

E. Rubber stair tread shall be as manufactured by Tarkett or approved equal by the Architect.

F. Test Data:

1. Hardness (ASTM D2240): ≥ 85 Shore A
2. Resistance to Chemicals (ASTM F925): Passes
3. Resistance to Heat (ASTM F 1514): $\Delta E \leq 8$
4. Static Coefficient of Friction (ASTM D 2047): ≥ 0.5 SCOF
5. Flamability (ASTM E648, Critical Radiant Flux): Class 1 (≥ 0.45 W/cm2)
6. Limited Commercial Warranty: 5 years

G. The treads shall be homogeneously constructed of first-quality raw materials, and the color shall extend throughout the thickness of the tread.

H. All treads shall be free from objectionable odors, blisters, cracks, and other imperfections which will affect the serviceability of the treads.

I. The treads shall conform fully with ASTM F-2169 Standard Specification for Resilient Stair Treads, Type TS, Class 1 and 2, Group 1 and 2.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

B. Adhesives: As recommended by Tarkett to meet site conditions.

1. Tarkett 930 Two-Part Epoxy Nose Caulk
2. Tarkett 946 Premium Contact Adhesive (Non-porous surfaces).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work**.**

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to Tarkett written instructions to ensure proper adhesion of Resilient Flooring.

1. Prepare concrete substrates in accordance with ASTM F 710.

    a. Concrete treads must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.
    b. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

2. Wood subfloors must be rigid, free of movement.

    a. Single wood and tongue and groove subfloors should be covered with ¼" or ½" APA approved underlayment plywood.
    b. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 STAIR TREAD INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient stair treads.

B. Install with Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.

C. Stair Treads with Integral Riser use a cove filler strip where the tread meets the riser.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. No traffic for 24 hours after installation.
2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

D. Wait 72 hours after installation before performing initial cleaning.

E. A regular maintenance program must be started after the initial cleaning.

F. Remove from the site and legally dispose of all cartons, rubbish, and debris resulting from the work of this Section.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096519 – RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 033000 – Cast-in-Place Concrete
C. Section 035413 – Self-Leveling Gypsum Underlayment
D. Section 035416 – Self-Leveling Cementitious Underlayment
E. Section 061000 – Rough Carpentry
F. Section 090561.13 – Moisture Vapor Emission Control

1.03 REFERENCES

A. ASTM International:

1. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
2. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
3. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
4. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
5. ASTM F 1066 Standard Specification for Vinyl Composition Tile
6. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
7. ASTM F 1700 Standard Specification for Solid Vinyl Tile
8. ASTM F 1861 Standard Specification for Resilient Wall Base
9. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
10. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

B. National Fire Protection Association (NFPA):

1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials
3. NFPA 255 Standard Test Method of Test of Surface Burning Characteristics of Building Materials

1.04 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer without defects, damage, or failure.

B. Administrative Requirements

1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e., moisture tests, bond test, pH test, etc).

C. Test Installations/Mock-ups: (Only if indicated on the Drawings) Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.

1. Mock-Up Size: 4' x 4'.

2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

3. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.

D. Sequencing and Scheduling

1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.

2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit manufacturer's technical data and installation instructions for each type of resilient flooring, adhesives and accessories.

2. Include manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.

C. Samples: (Digital Sample Cards only)

1. For projects requiring initial selection of color and pattern by Architect, submit samples in form of actual sections of resilient flooring, including accessories, showing manufacturer's full range of colors and patterns available, for each type of resilient flooring required.

2. For projects requiring verification of previously selected styles and colors; submit, for verification purposes, samples of each type, color, and pattern of resilient flooring, including accessories, selected by Architect, indicating full range of variation in color and pattern selected. Provide full-size tile units and minimum 2 1/2" long sections of resilient flooring accessories.

D. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers,

patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.

E. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Section 017000 – Contract Closeout. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

2. Warranty: Warranty documents specified herein.

F. Replacement Material:

1. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.

2. Submit to Owner at project site one box of each type and color of tile for each 50 boxes (or fraction thereof) of each type and color installed.

1.06 QUALITY ASSURANCE

A. Select an installer who is experienced and competent in the installation of Armstrong resilient vinyl composition tile flooring and the use of Armstrong Flooring subfloor preparation products.

1. Engage installers certified as Armstrong Commercial Flooring Certified Installers.
2. Confirm installer's certification by requesting their credentials.

B. Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:

1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less

C. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.”

1.07 PRODUCT DELIVERY AND STORAGE

A. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors, patterns, and quality designations legible and intact.

B. Do not open containers or remove markings until materials are inspected and accepted by installation contractor.

C. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

D. Unless otherwise indicated, store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Armstrong, but not less than 55 deg F or more than 85 deg F.

E. All products should be inspected for dye lot, style, color, size, quality and shipping damage prior to installation and should not be installed if any irregularities are observed. Inspect the cartons to be sure all colors are the same shade.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Temperatures provided for installation and initial finishing shall be maintained at levels in accordance with manufacturer's requirements.

C. Maintain ambient temperatures within range recommended by Armstrong, but not less than 65 deg F or more than 85 deg F in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

D. Maintain the ambient relative humidity between 40% and 60% during installation.

E. Until Substantial Completion, maintain ambient temperatures within range recommended by Armstrong, but not less than 55 deg F or more than 85 deg F.

1.09 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65º F and a maximum temperature of 100º F for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55º F in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to product installation recommendations for a complete guide on project conditions.

1.10 LIMITED WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period: 5 years for VCT, 20 years for LVT Flooring.

C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Resilient tile flooring, wall base, adhesives and subfloor preparation products and accessories.

1. Armstrong Flooring Inc.,
   1770 Hempstead Road, Lancaster, PA 17605
   www.armstrongflooring.com/commercial, or equivalent.

2.02 RESILIENT TILE FLOORING MATERIALS

A. Provide Vinyl Composition Tile: Standard Excelon® Imperial® Texture Tile Flooring or Premium Excelon® Crown Texture™ manufactured by Armstrong Flooring, Inc or equivalent.

1. Description: Tile composed of polyvinyl chloride resin, plasticizers, fillers, stabilizers and pigments with colors and texture dispersed uniformly throughout its entire thickness.

2. Vinyl composition tile shall conform to the requirements of ASTM F 1066, “Standard Specification Vinyl Composition Floor Tile", Class 2, through-pattern.

3. Pattern and Color: Unless otherwise specified, color shall be as selected by the Architect from manufacturer’s full range of standard VCT patterns and colors. Pattern to match existing where appropriate or as shown on finish floor plans. In the event that the finish floor plans in part or in their entirety are not provided herein, the bid shall include a minimum of two and/or three colors in a full tile basic pattern as determined by the Architect.

4. Size: 12 in. x 12 in. unless otherwise shown

5. Thickness: 1/8 in.

6. Interior Floor Finish Requirements: Interior floor finish shall meet or exceed the requirements of The Building Code of New York State.

   a. The flooring specified is classified in accordance with NFPA 253 as: Class 1, Critical Radiant Flux 0.45 watts/cm2 or greater.
   b. Flame spread rating less than 25 and smoked developed not to exceed 450, in accordance with by ASTM E-84.

7. Slip resistance: ADA compliant with a static coefficient of friction of 0.6 for level surfaces and 0.8 for ramps.

8. Test data:

   a. Heat Stability - (ASTM F1514): ΔE < 8
   b. Size/Squareness - (ASTM F2055): Passes
   c. Deflection - (ASTM F1304): Passes
   d. Chemical Resistance - (ASTM F925): Passes
   e. Static Load Resistance - (ASTM F970): 2000 psi, < 0.005 inches
   f. Residual Indentation - (ASTM F1914): Passes
   g. Slip Resistance - (ASTM D2047): ≥ 0.5 SCOF
   h. Dimensional Stability - (ASTM F2199): Passes
   i. Impact Resistance - (ASTM F1265): Passes
   j. Flammability - (ASTM E648 Critical Radiant Flux): Class 1 (≥ 0.45 W/cm2)
   k. Smoke Density - (ASTM E662): ≤ 450
   l. Limited Commercial Warranty: 5 years

9. Other Manufacturers offering products complying with these requirements include:

   a. Mannington Commercial; Calhoun, GA.

B. Provide Duo™, Exchange™ or Natural Creations™ Luxury Vinyl Tile (LVT) Flooring manufactured by

Armstrong Flooring Inc., or equivalent.

1. Description: A layered construction consisting of a tough, clear, rigid vinyl wear layer protecting a high-fidelity print layer on a solid vinyl backing. Protected by a diamond-infused UV-cured polyurethane finish, the wear surface is embossed with different textures to enhance each of the printed visuals. Colors are insoluble in water and resistant to cleaning agents and light.

2. Reference specification - ASTM F 1700, “Standard Specification for Solid Vinyl Tile", Class III, Type B – Embossed Surface. Meets requirements for size, squareness, thickness, thickness of wear layer, residual indentation, resistance to chemicals, resistance to light and resistance to heat.

3. Pattern and Color: Unless otherwise specified, color shall be as selected by the Architect from manufacturer’s current full range of industry colors. Pattern to match existing where appropriate or as shown on finish floor plans. In the event that the finish floor plans in part or in their entirety are not provided within. Include a minimum of two and/or three colors in a full tile basic pattern as determined by the Architect.

4. Size: 6” x 36”, unless otherwise shown

5. Wear layer thickness: 0.020 in. (0.5 mm)

6. Thickness: 0.100 in. (2.5 mm)

7. Interior Floor Finish Requirements: Interior floor finish shall meet or exceed the requirements of The Building Code of New York State.

    a. The flooring specified is classified in accordance with NFPA 253 as: Class 1, Critical Radiant Flux 0.45 watts/cm2 or greater.
    b. Flame spread rating less than 25 and smoked developed not to exceed 450, in accordance with by ASTM E-84.

8. Slip resistance: ADA compliant with a static coefficient of friction of 0.6 for level surfaces and 0.8 for ramps.

9. Test data:

    a. Heat Stability - (ASTM F1514): $\Delta E < 8$avg.,max
    b. Chemical Resistance - (ASTM F925): Passes
    c. Static Load Resistance - (ASTM F970): 2000 psi, < 0.005 inches
    d. Residual Indentation - (ASTM F1914): Passes
    e. Slip Resistance - (ASTM D2047): ≥ 0.5 SCOF
    f. Flammability - (ASTM E648 Critical Radiant Flux): Class 1 (≥ 0.45 W/cm2)
    g. Smoke Density - (ASTM E662): ≤ 450
    h. Limited Commercial Warranty: 20 years

10. Other Manufacturers offering products complying with these requirements include:

    a. American Biltrite Flooring, Sherbrooke, QC.
    b. Polyflor Ltd., Manchester, UK.

2.03 ACCESSORIES

A. Manufacturer: Roppe Corporation, 1602 N Union St., Fostoria, OH 44830. P: (800) 537 – 9527, or equivalent.

B. Rubber Wall Base:

1. Product Name: Pinnacle

2. Material Specification: ASTM F1861, Type TS – rubber, vulcanized thermoset; Group 1 – solid, (homogenous); Style B – Cove except as may be detailed in finish floor plans or as selected by the Architect.

3. Material Height: 4” high unless otherwise noted on Drawings.

4. Material Thickness: ASTM F386, 1/8” (3.2 mm)

5. Material Length: 120’ length.

6. Limited Warranty: 1 Year, Manufacturing only.

7. Material & Composition: 100% vulcanized homogenous rubber compound comprised of a premium blend & SBR rubber materials.

8. Color: As may be detailed in the finish floor plans or as selected by Architect from the manufacturer’s full range of colors including premium colors. In the event that the finish floor plans in part or in their entirety are not provided herein, for bidding purposes, the Contractor shall utilize and, therefore, for inclusion in the scope of work and contract, that 100 percent of all rubber cove base shown to be provided shall be of Premium Colors or equal.

9. Interior Floor Finish Requirements: Interior floor finish shall meet or exceed the requirements of The Building Code of New York State.

    a. The flooring specified is classified in accordance with NFPA 253 as: Class 1, Critical Radiant Flux 0.45 watts/cm2 or greater.
    b. Flame spread rating less than 25 and smoked developed not to exceed 450, in accordance with by ASTM E-84.

10. Corners: Provide inside and outside corners where noted.

11. Test data:

    a. Surface Burning: ASTM E84/NFPA 255 - Class B
    b. Flammability/Critical Radiant Flux: ASTM E648 / NFPA 253 - Class 1 (>0.45 Watts per sq. cm.), .082 W/cm^2
    c. Smoke Density: ASTM E662/NFPA 258 - Passes (<450), 157 (flaming) - 197 (non-flaming)
    d. Substrate Preparation: Per ASTM F710 and Roppe Technical Data Sheet

B. Accessories:

1. The Contractor shall utilize for bidding purposes and, therefore, for inclusion in the scope of work, all transitional reducers, reducer strips, cove caps, thresholds, edging, fillet strips and/or joiners as may need to be required by the project and/or Architect to provide a complete and acceptable project. All accessories shall be rubber and as manufactured by Johnsonite by Armstrong, ColorMatch colors or equal or luxury vinyl tile moldings to match specified pattern by moldingsonline.com.

C. Adhesives (Cements):

1. Waterproof, stabilized type as recommended by flooring manufacturer for the type of tile to be installed. Asphalt emulsions and other non-waterproof types are not acceptable.

D. Concrete Slab Primer:

1. Non-staining type as recommended by flooring manufacturer.

E. Leveling and Patching Compounds

1. Trowel Grade, featherable, latex modified Portland cement or blended hydraulic cement-based formulation acceptable to the flooring manufacturer.

2. Gypsum based compounds shall not be used in slab on grade construction and will only be considered where specifically approved by the flooring manufacturer.

PART 3 - EXECUTION

3.01 MANUFACTURE'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

B. Ensure substrate meets the requirements of ASTM F710, Roppe Technical Data Sheets and Excelsior Technical Data Sheets.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e., moisture tests, bond test, pH test, etc.).

B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Defects or conditions that would adversely affect quality and execution of installation.
2. Deviations beyond allowable tolerances of surfaces to receive resilient flooring:

a. Maximum variation in sub-floor surfaces: 1/8 inch in 10 feet.

3.03 PREPARATION

A. Prepare substrates according to Armstrong written instructions to ensure proper adhesion of Resilient Flooring.

1. Prepare concrete substrates in accordance with ASTM F 710.

a. Concrete floors must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.

b. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

2. Moisture Testing: Perform moisture testing as recommended by manufacturer. Proceed with installation only after substrates have been tested and meet the minimum requirements from the manufacturer in accordance with ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride or ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

a. When slab moisture content is in excess of manufacturer's requirements and if further drying is not possible, it may be necessary to install a moisture vapor barrier. If such a barrier product is determined to be required the product shall be deemed acceptable by the flooring and adhesive manufacturer'. The cost for application for such a barrier if not otherwise specified is considered an additional cost to the project. Added cost shall be agreed prior to proceeding.

b. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. A pH test for alkalinity must be conducted on the concrete floor prior to installation with results conforming to manufacturer requirements. If the test results are not within the acceptable range, then installation must not proceed until the problem has been corrected

c. VCT

1) Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.
2) Special Note: If MVER is greater than 5 lbs. but less than 8 lbs. consult manufacturer for special adhesive recommendations.
3) Perform relative humidity test using in situ probes, ASTM F 2170. Results must not exceed 80%.
4) Special Note: If MVER is greater than 80% but less than 90% consult manufacturer for special adhesive recommendations.

d. LVT

1) ASTM F1869 and ASTM F2170 and pH testing is required when installing LVT. Testing should be performed in several areas including the perimeter of the room, at columns and wherever else moisture might occur. The maximum allowable moisture vapor emission rate (MVER) from the subfloor is 6.0 lbs. The maximum pH range is 9 or less. The In-Situ/RH requirement is not to exceed 75%. Three test results for the first 1,000 sq. ft. are required, with 1 test result for every 1,000 sq. ft. thereafter. The installer may alternate every 1,000 sq. ft. between RH and Calcium Chloride test sites after the first

1,000 sq. ft.

B. Wood subfloors must have a minimum of 18” of cross-ventilated space beneath the bottom of the joist.

1. The floor must be rigid, free of movement.

2. Single wood and tongue and groove subfloors should be covered with ¼” or ½” APA approved underlayment plywood.

a. Use ¼” thick underlayment panels for boards with a face width of 3” or less.
b. Use ½" thick underlayment panels for boards with a face width wider than 3".

3. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

C. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Fill all minor cracks in substrates using approved crack filler in accordance with manufacturer's printed instructions.

E. Flash patch with products acceptable to the resilient flooring manufacturer. If condition requires self-levelling underlayment, refer to that specification in Division 03.

F. Clean substrates of all dirt and loose particles before application of flooring materials.

G. Provide additional underlayment and build up to abutting dissimilar flooring materials.

H. Floor covering shall not be installed over expansion joints.

I. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

J. Store and use adhesives in accordance with the manufacturer's printed instructions.

K. Proceeding with installation constitutes acceptance of the substrate conditions.

L. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.04 INSTALLATION

A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems. Failure to comply may result in voiding the manufacturer’s warranty listed in Section 1.10. Strictly adhere to manufacturer's written instructions and the following:

1. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

2. If required, install flooring on pan-type floor access covers. Maintain continuity of color and

pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

3. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

4. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

5. Lay resilient tile so as to ensure full uniform contact with substrate and to produce finished surfaces, which are smooth, even, and in true plane, free of buckles, waves, or other imperfections.

6. Cut and scribe tile neatly into breaks and recesses, walls, door frames, casework, and around pipes, columns, and other projections where flashed base is not required.

7. Lay tile square with room axis. Do not install border tiles that are less than 1/2 the width of a field tile. Tile against walls shall be the same width on each side of room.

8. Tile pattern when laid shall lie in an alternating direction as determined by the Architect.

9. Install with Armstrong adhesive specified for the site conditions and follow adhesive label for proper use.

10. Open enough cartons of floor tiles to cover each area, and mix tile to ensure shade variations do not occur within any one area.

11. Roll the flooring in both directions using a 100 pound three-section roller.

12. Vinyl Tile flooring must be welded. Note: It is recommended to heat weld seams to provide a more sterile and water tight seam.

13. Armstrong Resilient Sheet Flooring may be flash coved.

    a. Use Johnsonite CFS-00-A Cove Filler Strip.
    b. Net fit flooring material into the appropriate Johnsonite cove cap.

B. Rubber Base:

1. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths if practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

2. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

3. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

4. Comply with Roppe's written instructions for installing rubber base.

5. Use approved cove base adhesive and apply in accordance with manufacturer's printed instructions. Adhesive shall hold base tightly in contact.

6. Where necessary, patch and fill back-up material with underlayment material to provide continuous, uniform surface.

7. Scribe base accurately; use specified preformed corners; butt joints between sections tightly.

8. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is either indicated or required.

9. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

10. Tightly adhere resilient wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

11. Do not stretch resilient base during installation.

C. Reducing Strips: Install at points of transition from new resilient flooring to dissimilar flooring material. Whenever possible, locate strips between door jambs centered under doors.

3.05 ADJUSTMENTS

A. Reset any tiles which have not seated in a level plane with surrounding tiles.

B. Carefully remove and replace any tiles with broken corners with surrounding tiles.

3.06 CLEANING AND PROTECTION

A. Perform initial and on-going maintenance according to the latest edition of the Maintenance Instructions for Vinyl Composition & Bio-Based Tile.

B. Protect floors from rolling loads for 72 hours after installation by covering with hardboard or plywood. Protect the floor with un-dyed, untreated building paper until final inspection.

C. Initial cleaning and maintenance is the responsibility of the installing contractor and must be performed as soon as possible after installation. Initial cleaning may be not be performed until 3 days (72 hours) after installation or as otherwise specified by the manufacturer. The intent is to allow the tile become well seated in the adhesive and to prevent excess moisture and cleaning agents from interfering with the adhesive bond. Sweep and protect the floor until initial cleaning and maintenance can begin.

D. Initial Cleaning and Maintenance after Installation:

1. Sweep or vacuum floor thoroughly.

2. Clean flooring utilizing a pH neutral cleaner such as Super Shine All by Hillyard. Allow to stand for 5-15 minutes, but do not allow to dry. Scrub with a single disc rotary machine (175-350 rpm) with a blue or green pad. Remove solution and rinse with clean water. Allow flooring to dry completely before applying finish.

   a. Heavily soiled floor may require a stripping procedure as the initial cleaning.

3. Floor finish:

   a. For VCT, Apply four coats of a manufacturer approved high quality commercial floor finish such as Super Hil-Brite by Hillyard, allowing to dry completely between coats.

3.07 CLEAN UP

A. Remove from the site and legally dispose of all cartons, rubbish, and debris resulting from the work of this Section.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096566.11 – INDOOR RESILIENT ATHLETIC SURFACING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Supply and installation of the indoor resilient multipurpose surfacing.

B. Application of the game lines.

C. References for the correct construction and preparation of concrete slabs to receive resilient flooring.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 033000 – Cast-in-Place Concrete
C. Section 035413 – Self-Leveling Gypsum Underlayment
D. Section 090561.13 – Moisture Vapor Emission Control

1.03 REFERENCED STANDARDS AND GUIDELINES

A. ASTM F2170 “Standard Test Method for Determining Relative Humidity In Concrete Floor Slabs Using In-Situ Probes”

B. ASTM F710 “Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring”

C. ACI 302.2R-06 “Guideline for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.”

1.04 SUBMITTALS

A. Product Data:

1. Manufacturer’s promotional brochures, specifications and installation instructions.

B. Samples:

1. Submit for selection and approval three (3) sets of the indoor resilient multipurpose surfacing, manufacturer’s brochures, samples or sample boards of all of the available colors, textures and styles.

2. Submit color samples of all the available game line paint colors for selection and approval.

C. Closeout Submittals:

1. Submit three (3) copies of the indoor resilient multipurpose surfacing and manufacturer’s maintenance instructions.

2. Submit three (3) copies of the material and installation warranties as specified.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. The indoor resilient multipurpose surfacing shall have been actively marketed for a minimum of five (5) years.

2. The indoor resilient multipurpose surfacing shall be manufactured in an ISO 9001 certified plant.

3. The indoor resilient multipurpose surfacing supplier shall be an established firm experienced in the field and appointed as a distributor by the manufacturer of the indoor resilient multipurpose surfacing.

4. The installer of the indoor resilient multipurpose surfacing shall have a minimum of five (5) years experience in the field installing indoor resilient multipurpose surfacing and have worked on at least five (5) projects of similar size, type and complexity.

B. Certifications:

C. Installer to submit the indoor resilient athletic surfacing manufacturer's or distributor's certification attesting that they are an approved installer of the indoor resilient multipurpose surfacing.

D. Testing:

1. Tests shall be relative for multi-purpose use with certificates from independent testing resources to be made available upon request. Test results shall be no more than 5 years old and performed according to ASTM and/or EN standard testing procedures.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Material shall not be delivered until all related work is in place and finished and/or proper storage facilities and conditions can be provided and guaranteed stable according to FieldTurf USA, Inc. recommendations.

B. Storage:

1. Store the material in a secure, clean and dry location. Maintain temperature between 55◦ and 85◦ Fahrenheit. Store the indoor resilient athletic surfacing on a clean flat surface. Do not stack rolls.

1.07 PROJECT/SITE CONDITIONS

A. It is the responsibility of the general contractor/construction manager to maintain project/site conditions acceptable for the installation of the indoor resilient multipurpose flooring.

B. The area in which the indoor resilient multipurpose surfacing will be installed shall be dry and weather tight. Permanent heat, light and ventilation shall be installed and operable.

C. All other trades shall have completed their work prior to the installation of the resilient athletic flooring. The general contractor or Construction Manager shall maintain a secure and clean working environment before, during and after the installation. Suspension of other trades' work may be authorized providing their work will not damage the new flooring.

D. Maintain a stable room temperature of at least 65◦F for a minimum of one (1) week prior to, during and thereafter installation.

E. An effective low-permeance vapor barrier is placed directly beneath the concrete subfloor. For “on” or “below grade” installations, it is recommended to provide a permanent vapor barrier resistant to long term hydrostatic pressure/moisture exposure. Protrusions should be sealed to prevent moisture migration into the slab. Moisture should not be allowed to enter the slab after the completed construction.

F. Concrete subfloor surface pH level within the 7 to 9 range dependent upon installation type.

G. Concrete subfloor should be no greater than 1/8" within a 10 ft diameter. This tolerance can be measured in accordance with ASTM E1155. A specified (FF) of 50 and an (FL) of 30 should reach this degree of floor flatness and floor level. There is no numerical correlation between F numbers and the deviation from the straight edge, however the above specified numbers should achieve a flat floor with minimal deviation in the slab. Reference ACI 117 and ACI 302.1R. The General Contractor should provide a certificate of compliance with the above recommendations

H. Concrete subfloor must be clean and free of all foreign materials or objects including, but not limited to, curing compounds and sealers.

I. Fill cracks, grooves, voids, depressions, and other minor imperfections with Ardex (or equal) cement-based patching/leveling compounds. Follow the manufacturer’s directions. Moveable joints must be treated utilizing specific transitioning joint devices depending upon the architect’s recommendations. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.

J. Refer to ACI 302.2R “Guidelines for Concrete Slabs that Receive Moisture- Sensitive Flooring Materials” for concrete design and construction.

K. Concrete slab shall be fortified with continual steel reinforcement. Fiber reinforcement alone shall not be considered adequate fortification.

1.08 WARRANTY

A. Materials:

1. The indoor resilient athletic surfacing shall be covered by the manufacturer against product defects for 3 years.

B. Installation:

1. The installation of the indoor resilient multipurpose surfacing shall be covered against poor workmanship and faulty installation by a two (2) year written, limited warranty provided by the contractor performing/overseeing the installation.

1.09 ADDITIONAL MATERIALS

A. Furnish to the owner additional materials containing a total of at least 1% of each different color or design of the indoor resilient athletic surfacing used on the project.

1.10 LEED™ CERTIFICATION

A. The indoor resilient athletic surfacing should be able to help this facility to achieve points towards *LEED™ certification.*

B. LEED categories positively affected by the indoor resilient athletic surfacing:

Product Type			Rubber
Building Reuse Maintain Interior Nonstructural Elements	**MR 1.2**	Renovation	1
Construction Waste Management	**MR 2**	Renovation	2
Construction Waste Management Materials Reuse	**MR 3** **5 % - 1 point** **10% - 2 points**	Renovation	2
Recycled Content	**MR 4** **20% - 2 points**	New/Renovation	2
Regional Materials	**MR5**	New/Renovation	2
Indoor Environmental Air Quality Low VOC Adhesives/Sealants	**IEQ 4.1**	New/Renovation	1
Low-emitting Materials Paints and Coatings	**IEQ 4.2**	New/Renovation	1

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The basis of the design for the indoor resilient multipurpose surfacing is **Dropzone Speckle Interlocking tiles, straight edge tiles or rolls** as provided by FieldTurf USA, Inc / Tarkett Sports. All other installation accessories and related components must be either made or approved by the indoor resilient athletic surfacing manufacturer. Other products may be approved as equal if deemed qualified and submitted in accordance with the General Conditions. Test reports confirming compliance from an Independent Sports Laboratory must be provided along with samples, technical data, installation, maintenance, and warranty prior to acceptance as an alternative product.

2.02 MATERIALS

A. Dropzone Speckle Interlocking 8mm recycled non-laminated rubber flooring.

1. Physical properties of the indoor resilient athletic surfacing shall conform to the following minimums:

Width	…….	Roll Width 4ft – Tile 2ft x 2ft
Length	…….	Specify length (min. 15 ft)
Total Thickness	…….	8 mm
Weight	…….	1.92 lbs/sq.ft.
Tensile Strength	ASTM D412	200 minimum
Static Load	ASTM F970	1000 p.s.i (modified test)
Coefficient of Friction	ASTM 2047	>.9
Chemical Resistance	ASTM F925	Excellent
Ambient Noise Reduction	ASTM C423	.10
Impact Sound Insulation	ASTM E492	.45 minimum

Thermal Conductivity	ASTM C518	Approximate .406
Sound Transmission	ASTM 413	.45 minimum

2. Color: As available from the indoor resilient athletic surfacing manufacturer's standard range.

3. Adhesive: As approved by the indoor resilient athletic surfacing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. It is the responsibility of the general contractor/construction manager to ensure that project/site conditions are acceptable for the installation of the indoor resilient athletic flooring.

B. Verify that the area in which the indoor resilient athletic surfacing will be installed is dry and weather tight. Verify that permanent heat, light and ventilation is installed and operable.

C. Verify that all other work that could cause damage, dirt and dust or interrupt the normal pace of the indoor resilient athletic flooring installation is completed or suspended.

D. Verify that there is a stable room temperature of at least 65◦F.

E. Verify that there are no foreign materials or objects on the subfloor and that the subfloor is clean and ready for installation.

F. *Direct Full Spread Adhering to Concrete Subfloor*: moisture content less than 98 % RH when tested per ASTM F2170. Use only manufacturer recommended Multi-Poxy adhesive.

G. If both tests are performed, use the highest value. Do not average the results of the tests. Report all field test results in writing to the General Contractor, Architect, and End User prior to installation.

H. Verify that the concrete subfloor surface pH level is within the 7 - 9 range.

I. Document the results indicating the slab is within manufacturer's tolerances for slab deviation.

3.02 PREPARATION OF SURFACES

A. Sand the entire surface of the concrete slab.

B. Sweep the concrete slab so as to remove all dirt and dust. If a sweeping compound is to be used it must be a sweeping compound that does not contain oil or other items that may inhibit the adhesive bond.

C. Slab must be dust free. In the event that dust impairs adhesive bond, priming the slab prior to application of adhesive may be necessary. Follow installation guidelines.

3.03 OPTIONS FOR MOISTURE MITIGATION

A. For projects with moisture conditions higher than the specified tolerances, **TARKOLAY** may be used for conditions that do not 98% per ASTM F2170. Use only approved adhesive as directed by the manufacturer. Tarkolay is available for roll goods only.

3.04 INSTALLATION

A. The installation area shall be closed to all traffic and activity for a period to be set by the indoor resilient athletic surfacing installer. The indoor resilient athletic surfacing installation shall not begin until the installer is familiar with the existing conditions.

B. All necessary precautions should be taken to minimize noise, smell, dust, the use of hazardous materials and any other items that may inconvenience others.

C. Install the indoor resilient athletic surfacing in strict accordance with the indoor resilient athletic surfacing manufacturer's written instructions.

D. Install the indoor resilient athletic surfacing minimizing cross seams. Provide a seam diagram during the submittal process for approval prior to installation.

E. Install appropriate threshold plates or transition strips where necessary.

3.05 CLEANING

A. Remove all unused materials, tools, and equipment and dispose of any debris properly. Clean the indoor resilient athletic surfacing in accordance with the manufacturer's instructions.

3.06 PROTECTION

A. If required, protect the indoor resilient athletic surfacing from damage using coverings approved by the manufacturer until acceptance of work by the customer or their authorized representative.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096623 – THIN-SET EPOXY TERRAZZO FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish necessary material, labor, and equipment required to prepare designated areas and install a new epoxy thin-set terrazzo flooring system and base to match existing or new installations, as shown on the contract drawings. (Note: General Contractor to allow for slab depressions as required for the installation of this product).

B. All work and materials shall be in strict accordance with the complete specifications of the National Terrazzo and Mosaic Association, Inc. (NTMA).

C. Drawings and General Provisions of Contract including General and Special Conditions and Division 01, excepting special Submittal and Quality Assurance provisions in this section.

D. Refer to Sherwin-Williams Guide Specification “Cast In Place Concrete Floor Slabs on Grade That Will Receive Semi-permeable Or Impermeable Floor Finishes” for concrete mix design and accessories, including curing of concrete and vapor barrier for slabs on grade.

1.02 SUMMARY

A. Section includes:

1. Epoxy terrazzo with divider and accessory strips.
2. Precast terrazzo units.

B. Related Requirements:

1. Attach metal stairs including any welding and/or reinforcing.
2. Provide floor drains at epoxy terrazzo flooring.
3. Provide surface hardware at epoxy terrazzo flooring.
4. Set architectural reveals or metal base beads requiring installation prior to wall surface.
5. Concrete subfloor.
6. Stair Nosing-Miscellaneous Metals.
7. Backing for poured in place epoxy terrazzo base shall be masonry or cement board at least 1/2 inch thick.
8. Backing for precast epoxy terrazzo base shall be 1/2 inch or greater thickness cement board, gypsum board or equivalent.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: The General Contractor shall conduct a conference at Project site before Terrazzo Contractor begins installation.

1. The General Contractor shall invite Terrazzo Contractor, the Architect, and representatives of the Owner.

2. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review terrazzo mixes and patterns.
d. Review custom terrazzo mixes, designs, and patterns.
e. Coordination with the Work of other Installers.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Terrazzo Contractor shall submit Product Data for each type of product required for installation including:

1. Strip materials.
2. Sealer.

C. Shop Drawings: Terrazzo Contractor shall prepare and submit Shop Drawings that include plans, elevations, sections, component details, and attachments to other work. Include terrazzo installation requirements. Show layout of the following:

1. Divider strips.
2. Control joints.
3. Expansion-joint materials.
4. Accessory strips.
5. Abrasive strips.
6. Stair treads, risers, and landings.
7. Terrazzo patterns.
8. Logos or special graphics.
9. Cove base.

D. Samples:

1. For verification of color and pattern by Architect, submit one 6" x 6" sample of actual terrazzo for each color and type of terrazzo specified.
2. For verification of color and pattern by Architect, submit one 6" x 6" sample of actual terrazzo for each color and type of precast terrazzo specified.
3. Submit one 12" long sample of metal divider strip.

E. Samples for Initial Selection: Terrazzo Contractor shall submit NTMA “Color Palette Brochure” showing full range of colors and patterns available for each terrazzo type.

1. Terrazzo: 6” x 6” Samples.
2. Accessories: 6 inch long Samples of each type and kind of exposed strip item required.
3. Precast Terrazzo Units: Samples, sizes 6” x 6” for each color and type of precast terrazzo specified

F. System Data: Submit manufacturer's specifications on cured system and individual components of the epoxy thin-set terrazzo flooring System, including physical properties and performance properties and tests described in Part 2.01 D and submit Material Safety Data Sheets. Each individual component of the system will be evaluated on the basis of these standards. For any tests not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data accompanied by the independent testing laboratory's test results which prove compliance in accordance with the referenced standard(s). Manufacturer's complete range color chart shall also be submitted and must afford the owner color selection from at least 50 standard colors and computerized custom color matching shall be available upon request.

G. Qualification Data: Terrazzo Contractor shall submit two copies of qualification data for Installer.

1. Include list of projects during the past 10 years indicating name, square footage and location of project, name of Owner, name and contact information for General Contractor, and name and contact information for Architect. Also, the contractor shall furnish résumés detailing the experience of key project personnel including supervisors and mechanics.
2. Include letter from NTMA with the name of the Project and name of member, stating current member status.
3. The installer shall furnish a letter from the epoxy thin-set terrazzo flooring system manufacturer's corporate offices stating that the concrete substrate has been tested for moisture vapor transmission and that the moisture vapor transmission levels do not exceed the epoxy thin-set terrazzo flooring system manufacturers' recommendations.

H. Closeout Submittals:

1. Maintenance Literature: Terrazzo Contractor shall submit two copies of NTMA maintenance recommendations.

1.05 QUALITY ASSURANCE

A. Acceptable Epoxy Resin Manufacturer: An Associate Member of the NTMA, experienced in manufacturing epoxy resin in accordance with NTMA standards and with a record of successful in-service performance as well as sufficient production capacity to produce required materials.

B. Acceptable Terrazzo Contractor: A Contractor Member of NTMA whose work has resulted in construction with a record of successful in-service performance.

1. Installer shall have completed terrazzo installations within the past 5 years of scale and complexity similar to the proposed installation.

C. Source Limitations for Aggregates: Terrazzo Contractor shall obtain each color, grade, type, and variety of granular materials from sources capable of providing materials of consistent quality in appearance and physical properties.

D. Mockups: Terrazzo Contractor shall construct mockup if required in bid or scope of work documents to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup as indicated on Drawings.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. For the purposes of this specification, and to identify a minimum level of quality, the design is based on a named product line. Such references shall be construed as establishing the quality of materials and workmanship to be used under this section, and shall not, in any way, be construed as limiting competition by other manufacturers offering products of identical material composition. Products used shall be those upon which the design is based, or shall be equal products, approved in advance, by the Architect. Bidders seeking approval for substitute materials shall submit their request in writing to the Architect on the Proposed Substitution Form located within the Bid Proposal Form package. The Architect is the sole judge on whether or not the proposed product is an equal. No substitutions will be considered after contract award.

F. The installer shall submit a copy of the manufacturer's packing slip, tagged for this specific job, along with calculations, signed by an authorized representative of the primary material supplier demonstrating that the quantity of material furnished for the project will achieve the specified

coverage and mil thicknesses. Prime Contractor shall review this package and confirm completeness and accuracy prior to submitting to the Architect's office for formal review.

1.06 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to Project site in supplier's original wrappings and containers, labeled with source or manufacturer's name, material or product brand name, and lot number if any.

B. Materials shall be stored in their original, undamaged and unopened packages and containers. Each container shall be clearly marked with the following:

- Product name(s) and/or Number(s)
- Manufacturer's name
- Component designation (A, B, etc.)
- Product Mix Ratio
- Health and Safety Information
- CHEMTREC Emergency Response Information

C. Store all materials in a clean, dry location and in accordance with NTMA standards.

1. Epoxy components shall be stored in a space where the ambient temperature can be maintained 60 and 90 deg. F before use.

D. Provide equipment and personnel to handle the materials by methods which prevent damage.

E. The prime contractor and installer shall promptly inspect direct jobsite material deliveries to assure that quantities are correct, comply with requirements and are not damaged. The Owner's Representative has the exclusive right to reject damaged materials.

F. The prime contractor and installer shall be responsible for materials furnished by him, and he shall replace, at his own expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling or storage.

1.07 QUALITY CONTROL

A. Maintain temperature in space to receive terrazzo per requirements of the NTMA.

B. Examine areas to receive terrazzo for defects in existing work that affect proper execution of terrazzo work, deviations beyond allowable tolerances for the concrete slab work, and that area is broom cleaned and free of foreign matter. Start work only when all defects are corrected.

C. The contractor shall visit the jobsite prior to the installation of the Thin-set Epoxy Terrazzo Flooring System to evaluate substrate condition, including substrate moisture transmission, quantity and severity of cracking, and the extent of repairs needed. Substrate imperfections should be repaired only after mechanical preparation of the substrate. Surface preparation reveals most imperfections requiring repair. Concrete substrates shall be tested to verify that the moisture vapor transmission of the substrate does not exceed the Resuflor Terrazzo TG System manufacturers' recommendations.

1.08 PROJECT CONDITIONS

A. General Contractor shall provide sufficient water, temporary heat and light, and adequate electric power with suitable outlets connected and distributed for use within 100 feet of any working space.

B. General Contractor shall provide temporary enclosures and other suitable methods to protect adjacent spaces from damage during installation.

1. The minimum slab temperature must be conditioned to 60 degrees F before commencing installation, during installation, and for at least 72 hours after installation is complete. The substrate temperature must be at least 5 degrees F above the dew point during installation.

2. Maintain adequate ventilation in the area to receive terrazzo.

C. Terrazzo Contractor shall protect other adjacent work from water and dust generated by grinding operations.

D. The contractor should exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, as well as in-place equipment. The contractor shall prepare the substrate to remove laitance and open the surface. This shall be achieved by light brush grit blasting. Surface profile achieved shall be similar to medium grit sandpaper and free from bond-inhibiting contaminants.

E. System must be protected by the General Contractor or by the installing contractor until it is inspected and turned over to the owner.

F. Maintain lighting at a minimum uniform level of 50 or more foot candles in areas where the Resuflor Terrazzo TG System is being installed. It is the recommendation of the manufacturer that the permanent lighting be in place and working during the installation.

G. Leaks from pipes and other sources must be corrected prior to the installation of the Resuflor Terrazzo TG System.

1.09 PROJECT WARRANTY

A. The contractor and the manufacturer shall furnish a standard guarantee of the Epoxy Thin-set Terrazzo Flooring System for a period meeting the requirements of Specification Section 017000. The labor and material guarantee shall include loss of bond and wear-through to the concrete substrate from normal use.

B. Not included in the warranty are damage due to structural design deficiencies including but not limited to slab cracking from lateral, vertical or rotational movement, and gouging or other damage due to fork lifts, other equipment, delamination caused by vapor transmission, Acts of God, or other elements beyond the scope of protection of this system nor causes not related to the system materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. New terrazzo and base shall match existing or new mix to match sample or as designed by Architect at locations indicated on drawings in all respects including color, pattern, and finish. Marble chip size, color, and type shall match existing. Divider strip gauge, material, and spacing shall match existing.

B. All materials used including water, sand, cement, grout, etc. shall conform strictly to the requirements of the NTMA.

C. System Overview: Resuflor Terrazzo TG System as manufactured by Sherwin-Williams.

1. **OPTION 1 (with Crack Bridging Membrane when required)**: The Resuflor Terrazzo TG System, consisting of Resuflor™ 3556, FS38-4.4 Fiberglass Scrim, Resuflor™ 3520 as the

binder resin, 5270 Epoxy Filler, #0, #1 and #2 Marble Chips, Resuflor™ 3520 as grout, and Acrydur™ 4503 as the seal coat. The total system thickness will be 3/8" nominal.

2. **OPTION 2:** The Resuflor Terrazzo TG System, consisting of Resuprime™ 3579 epoxy primer, Resuflor™ 3520 as the binder resin, 5270 Epoxy Filler, #0, #1 and #2 Marble Chips, Resuflor™ 3520 as grout, and Acrydur™ 4503 as the seal coat. The total system thickness will be 3/8" nominal.

3. Apply epoxy thin-set terrazzo flooring System over 40 mils thick Resuflor™ 3552W Flexible Epoxy on all elevated concrete floors as shown on drawings.

4. All underlayment used to level or fill between the concrete substrate and the thin-set epoxy terrazzo shall be composed of 100% solids epoxy as recommended by the thin-set epoxy terrazzo material manufacturer and graded aggregates combined to form an epoxy mortar. All epoxy underlayment shall be applied to an epoxy primed surface.

5. Apply General Polymers' *Recover 9000 Moisture Vapor Transmission Control System* to all concrete surfaces where the moisture vapor transmission levels exceed the epoxy thin-set terrazzo flooring system manufacturers' recommendations.

D. Epoxy thin-set terrazzo typical physical properties @ 73 F (unless otherwise noted):

Typical Physical Properties

Binder Resin

Color	Any custom color matching available upon request Able to match NTMA and TTMAC Standard color plates	
Hardness, @ 24 hours Shore D ASTM D 2240	85/65	
Compressive Strength ASTM D 695	10,000 psi	68.9 MPa
Tensile Strength ASTM D 638	3,000 psi	20.7 MPa
Flexural ASTM D 790	4,500 psi	31.0 MPa
Flexural Modulus ASTM D 790	500,000 psi	3445 MPa
Adhesion ACI 503R	300 psi concrete failure	2.4 MPa
Abrasion Resistance ASTM D 4060	70-90 milligrams lost	
Water Absorption ASTM D 570	.1%	

System

Critical Radiant Flux ASTM E 648	.90
Indentation MIL-D-3134J	None
Impact Resistance MIL-D-3134, Sec. 4.7.3	Withstands 16 ft-lbs without cracking, delamination or chipping
Resistance to Elevated Temperatures MIL-D-3134J	No slip or flow at required temperature of 158 degrees F
Slip Resistance	Meets ADA Standards (sealer)
Thermal Coefficient of Linear Expansion ASTM D 696	25 x 10-6 in/in/degrees

ASTM C = Mortar System
ASTM D = Resin only

2.02 MIXES

A. Colors:

1. NTMA Plate as selected by the Architect or Sherwin-Williams Plate as selected by the Architect.

2. List epoxy matrix color number and chip type, size and percent.

B. Marble Chips: The basis of design are aggregates supplied by Southern Aggregates.

1. Size to conform with NTMA gradation standards

2. Abrasion resistance when tested according to ASTM C 131 shall not exceed 40% loss.

3. Hardness to conform to ASTM C241, Ha-10 minimum.

4. 24 hour absorption rate not to exceed 0.75 %.

5. Chips shall contain no deleterious or foreign matter.

6. Dust content less than 1% by weight.

7. Chips shall show no effect when tested according to ASTM C 672 for three cycles.

C. Divider Strips: The basis of design is Manhattan American.

1. Stop and divider “L” strips: 16 gauge zinc.

2.03 PRECAST TERRAZZO

A. Precast Stair Treads:

1. Precast stair treads shall be cement or epoxy terrazzo manufactured according to NTMA standards.

a. Cement shall be ASTM C-150, white portland cement.
b. Epoxy resin shall be from the same manufacturer as used for epoxy terrazzo flooring.

2. Submit shop drawings of all precast terrazzo stair treads showing detail sections and profile of all precast items. Details shall show all reinforcing and any special hardware for fastening railings.

3. Color shall match approved thin-set epoxy terrazzo.

4. Submit samples according to Section 1.04.D.

B. Precast Base:

1. Precast floor base shall be epoxy terrazzo manufactured according to NTMA standards.

a. Epoxy resin shall be from the same manufacturer as used for epoxy terrazzo flooring.

2. Submit shop drawings of all precast base showing detail sections and profile of all precast items. Details shall show all reinforcing.

3. Color shall match approved thin-set epoxy terrazzo.

4. Submit samples according to Section 1.04.D.

2.04 MISCELLANEOUS ACCESSORIES

A. Sealer: Terrazzo Contractor shall provide a non-ambering, clear sealer that is chemically neutral; does not impair terrazzo aesthetics or physical properties; is recommended by terrazzo matrix manufacturer. Sealers shall comply with the following:

1. Comply with requirements of authorities having jurisdiction.

2. Comply with ASTM D 2047.

3. Water Based Sealer Properties: With pH factor between 7 and 10.

4. Solvent Based Sealer Properties: Flashpoint at 80 deg. F according to ASTM D 56.

B. Moisture Mitigation: Two-component, high solids, moisture tolerant, high density, low odor, epoxy-based product produced by epoxy terrazzo resin manufacturer specifically recommended to reduce alkalinity levels and moisture emission to acceptable levels.

PART 3 - EXECUTION

3.01 JOB CONDITIONS

A. The contractor shall visit the jobsite prior to beginning the installation of the epoxy thin-set terrazzo flooring system to evaluate substrate condition, including substrate moisture content, and the extent of repairs required, if any.

B. At least two weeks prior to the start of the epoxy thin-set terrazzo flooring system, the contractor shall test the concrete substrates to verify that the moisture content of the substrate does not exceed the epoxy thin-set terrazzo flooring System manufacturers' recommendations. All tests shall be performed using a calcium chloride crystal test approved by the epoxy thin-set terrazzo flooring system manufacturer.

C. The installer should exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, as well as in-place equipment. The installer shall prepare the substrate to remove laitance and open the surface. This shall be achieved by light brush grit blasting. Surface profile achieved shall be similar to medium grit sandpaper and free from bond-inhibiting contaminants. Costs incurred that are associated with damage from negligence or inadequate protection shall be the sole responsibility of the installing contractor.

D. Subfloor tolerances shall be in accordance with ACI 302. Each drain or cover in the installation area must be working and raised or lowered to the actual finished elevation of the epoxy thin-set terrazzo flooring system.

E. System must be protected by the General Contractor or, as a separate bid item, by the installing contractor until it is inspected and turned over to the owner.

F. The minimum slab temperature must be conditioned to 50 F before commencing installation, during installation, and for at least 72 hours after installation is complete.

G. Maintain lighting at a minimum uniform level of 50 or more foot-candles while being installed.

H. Leaks from pipes and other sources must be corrected prior to the installation of the epoxy thin-set terrazzo flooring system.

3.02 SURFACE PREPARATION

A. The Installing Contractor shall prepare concrete to "open" the surface pores by means of vacuum blasting or grinding (in conjunction with acid etching) to remove all contaminants or bond breaking substances, including but not limited to, dust, laitance, curing compounds, coatings, sealers, oil and grease. Shotblast profile shall be ICRI (International Concrete Repair Institute) standard profile of CSP 3-5. Any oil or grease not removed by these methods must be chemically removed. All delaminated or deteriorated concrete shall be mechanically removed by scabbling or chipping hammers. Areas to be patched should be saw cut to a minimum of 1/2" deep at the perimeters and keyed to the existing concrete. For thorough instructions regarding preparation of concrete and non-concrete substrates, consult “Instruction for Concrete Surface Preparation” (Form G-1).

3.03 INSTALLATION

A. General: Apply each component of the Resuflor Terrazzo TG System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions. The Thin-set Epoxy Terrazzo Flooring System is to be installed directly over non-moving control joints and cracks which have been treated with Resuflor™ 3556, and the Resuflor Terrazzo TG System will terminate at the edge of isolation and expansion joints as designated by the Architect. Integral cove base shall be installed where specified in the drawings.

B. Cracks and Control Joints:

1. Cracks: After preparation, evaluation of quantity and severity of cracks in concrete will determine the needed repairs. Bid assumes repair and treatment of cracks and control joints. For information pertaining to the treatment of cracks in concrete substrates, consult Manufacturer’s publication, Concrete 102.

2. Control Joints: Fill control joints with Resuflor™ 3552 Epo-Flex Flexible Epoxy. All control joints shall be overlaid with a 6 inch wide by 40 mils thick band of Flexible Epoxy Membrane into which a fiberglass scrim cloth has been embedded. Allow to cure prior to proceeding with terrazzo application. For information pertaining to the treatment of control joints in concrete substrates, consult Manufacturer’s publication, Concrete 103.

3. 100 percent fiber mesh reinforcement to be placed over entire substrate.

   Note to Installer: In new construction or where new concrete is placed, all cracks 1/16" and greater shall be filled with Resuflor™ 3552 Epo-Flex by the Installing Contractor. The Installing Contractor will be responsible for detailing these cracks prior to placing the thin-set epoxy terrazzo.

C. Isolation/Expansion and Other Joints Subject to Movement:

   1. Terminate epoxy thin-set terrazzo flooring system at the edge of all isolation and expansion joints and carry the detail through the epoxy thin-set terrazzo flooring system as shown on the drawings. All expansion joints must be honored through the flooring system. For information pertaining to the above, consult Manufacturer's publication, Concrete 105.

D. System Primer: Apply Resuprime™ 3579 epoxy primer per manufacturer's recommendations.

E. Flexible Epoxy Membrane: Apply 3552 Epo-Flex Flexible Epoxy Membrane at 40 mils thickness per manufacturer's recommendations.

F. Membrane: *(For Option 1)*

   1. Resuflor™ 3556.
   2. FS38-4.4 oz Fiberglass Scrim.

G. System Primer: *(required when not using the Crack Bridging Membrane)*

   1. Resuprime™ 3579.

H. Terrazzo Installation:

   1. Resuflor™ 3520 Epoxy Terrazzo Matrix as the binder resin 5270 Epoxy Filler #0, #1 and #2 Marble Chips as required.

   2. Perform all grinding operations per NTMA recommendations.

I. Grout Coat:

   1. Resuflor™ 3520 Epoxy Terrazzo Matrix. Use 3520 matrix mixed with 100% silica.

   2. Perform all fine grinding operations per NTMA recommendations.

J. Seal Coat:

   1. Acrydur™ 4503

K. Substrate Corrective Work/ Flash patching:

   1. Do not use self-leveling underlayment's specified in Division 3 of the Project Manual.

3.04 PRECAST TERRAZZO INSTALLATION

A. Terrazzo Contractor shall install precast terrazzo units as follows:

   1. Precast Terrazzo Base: Use latex-portland cement mortar or epoxy adhesive to install precast terrazzo base over substrates indicated according to ANSI 108.5 or ANSI 108.6.

2. Precast Terrazzo Stair Units: Use latex-portland cement mortar or epoxy]to install treads, risers, and landings over concrete substrates according to ANSI 108.5 or ANSI 108.6

3. Precast Terrazzo Stair Units: Use epoxy adhesive to install treads, risers, and landings over steel substrates according to ANSI 108.6.

3.05 REPAIR

A. Terrazzo Contractor shall repair terrazzo areas that evidence lack of bond between topping and underbed according to NTMA's written recommendations.

3.06 GRINDING/ POLISHING PROCEDURE

A. Grinding: Grind with 24 or finer grit stones or comparable diamond plates. Follow initial grind with 80 or finer grit stones.

B. Grouting: Cleanse floor with clean water and rinse. Remove excess rinse water and machine or hand apply grout taking care to fill voids. Note: Use resin-type grout for Thin-set systems.

C. Curing Grout: Grout may be left on terrazzo until all heavy and messy work in project is completed.

D. Fine Grinding: Grind with 80 or finer grit stones until all grout is removed from surface. Upon completion, terrazzo shall show a minimum of 70 percent marble chips.

E. Cleaning and Sealing: Wash all surfaces with a neutral cleaner and water. Rinse with clean water and allow to dry. Apply sealer in accordance with manufacturer's directions.

F. Protection: The Contractor shall protect the finished floor from the time the terrazzo Contractor completes the work.

3.07 CLEAN UP

A. Remove from the site and legally dispose of all cartons, rubbish, and debris resulting from the work of this Section.

3.08 CURING, CLEANING AND PROTECTION

A. Cure the Resuflor Terrazzo TG System materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.

B. Protect the Resuflor Terrazzo TG System from damage and wear during other phases of the construction operation, using temporary coverings as recommended by the manufacturer, if required. Remove temporary covering just prior to final inspection.

C. Clean the Resuflor Terrazzo TG System just prior to final inspection, using materials and procedures suitable to the system manufacturer.

D. Some cleaners will affect the color, gloss or texture of your polymer floor surfaces. To determine how your cleaner will perform, first test each cleaner, in a small area, utilizing your cleaning technique. This precaution will demonstrate the effect of your cleaner and technique. If no deleterious effects are observed, continue with the procedure. If deleterious effects do occur, modify the cleaning material and/or procedure. For recommendations regarding types of cleaners, contact the Resuflor Terrazzo TG System manufacturer.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096723.12 – RESINOUS FLOORING
ACCELERA C BROADCAST FLOOR SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General Conditions and Supplementary Conditions and Division 01 specification section, apply to work of this section.

1.02 SUMMARY

A. This section includes the following:

1. High-Performance Resinous flooring system as shown on the drawings and in schedules.

B. Related sections include the following:

1. Section 033000 – Cast-in-Place Concrete

1.03 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of a squeegee-applied resinous flooring system with Micro or Macro colored decorative chips and topcoat.

B. The system shall have the color and texture as specified by the Owner with a nominal thickness of 50 mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

C. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

1.04 SUBMITTALS

A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.

B. Manufacturer’s Safety Data Sheet (SDS) for each product being used.

C. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements. Resinous flooring shall be installed only by a company having no less than five (5) years experience installing this type of floor and approved in writing by the manufacturer.

D. Material Certificates: For each resinous flooring component, from manufacturer.

E. Samples: Submit two 3 x 3 inch square sampleS of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances for approval by Architect.

F. Test report by an independent testing laboratory certifying compliance with these specifications.

G. Before starting the full installation, construct on a job site a 4 x 8 foot sample panel demonstrating conditions and workmanship as they will occur to executed work. Finished work shall match

approved sample.

H. Shop drawings showing divider strips and other accessories required by the installation which affect appearance.

I. Copies of both the manufacturer's and installer's standard guarantee.

1.05 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

2. Installer Letter of Qualification: Installer to provide letter stating that they have been in business for at least 5 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.

E. Pre-installation Conference: Conduct conference at Project site before work and mockups begin and shall be held between Applicator, General Contractor and the Owner for review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule

F. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.

1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
2. Finish surfaces for verification of products, color, texture, and sheen.
3. Simulate finished lighting conditions for Architect's review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
5. Mockup shall demonstrate desired slip resistance for review and approval by Owner’s representative in writing.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

2. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.07 PROJECT CONDITIONS

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.

2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.

3. The application of Accelera where jobsite relative humidity is less than 30% is not recommended.

4. Use Accelera LH resin where jobsite relative humidity is between 10% and 30%.

5. The Applicator shall ensure that adequate ventilation is available for the work area.

6. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with cementitious urethane material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured for 28 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests. Outside of these parameters manufacturer shall be consulted.

2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).

3. Sealers and curing agents should not be used.

4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.

2. "No Smoking" signs shall be posted at the entrances to the work area.

3. The Owner shall be responsible for the removal of foodstuffs from the work area.

4. Non-related personnel in the work area shall be kept to a minimum.

1.08 WARRANTY

A. Dur-A-Flex, Inc, as manufactured by Sherwin-Williams and the Sherwin-Williams High Performance Flooring Division warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Sherwin-Williams/Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.

B. Liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 - PRODUCTS

2.01 FLOORING

A. Dur-A-Flex, Inc/Sherwin-Williams ACCELERA C seamless flooring system, as manufactured by Sherwin-Williams High Performance Flooring.

1. System Materials:

   a. Primer: Primer: Dur-A-Flex, Inc/Sherwin-Williams ACCELERA (EXT, LH, or Standard) pigmented resin and hardener.
   b. Broadcast Coat: Dur-A-Flex, Inc/Sherwin-Williams ACCELERA (EXT, LH, or Standard) resin and hardener.
   c. Chips: Dur-A-Flex, Inc/Sherwin-Williams Macro or Micro Decorative Colored Chips.
   d. Topcoat: Dur-A-Flex/Sherwin-Williams ACCELERA (EXT, LH, or Standard) resin and hardener.

2. Patch Materials

   a. Shallow Fill and Patching: Use Dur-A-Flex, Inc/Sherwin-Williams Dur-A-Glaze #4 Cove-Rez.
   b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc/Sherwin-Williams Poly-Crete WR.

2.02 MANUFACTURER

A. Acceptable Manufacturer: The Sherwin Williams Company, 101 Prospect Ave., Cleveland, OH 44115 or Architect approved equal.

B. Architectural Representatives Contact:
David Hughes | Email: davidh@dur-a-flex.com | Phone: 860-614-7567
Anthony Spanevello | Email: anthony.m.spanevello@sherwin.com | Phone: 516-406-0612
Field/Contractor Representative; Contact :
Paul Cicero | Email: paul.f.cicero@sherwin.com | Phone: 646-483-0258

C. Manufacturer of Approved System shall be single source and made in the USA.

2.03 PRODUCT REQUIREMENTS

A. Primer, Broadcasts and Topcoat	ACCELERA
1. Percent Solids	100%

2.	VOC	0 g/L (Satin topcoat 42 g/L)
3.	Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4.	Hardness, Shore D ASTM D2240	70
5.	Compressive Strength, ASTM C579	18,000 psi
6.	Tensile Strength, ASTM D638	2,600 psi
7.	Abrasion Resistance, ASTM D4060 C-17 Wheel, 1,000 gm load, 1,000 cycles	27 mg loss (Satin topcoat 22 mg. loss)
8.	Potlife @ 70 F	7 – 10 minutes
9.	Gloss (ASTM D523) 60°	90 (Satin topcoat 50 – 55)
10.	Coefficient of Friction (ASTM D2047)	0.6

B. Primer and Topcoat — ACCELERA EXT

1.	Percent Solids	96%
2.	VOC	33 g/L
3.	Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4.	Hardness, Shore D ASTM D2240	70
5.	Compressive Strength, ASTM C579	18,000 psi
6.	Tensile Strength, ASTM D638	2,600 psi
7.	Abrasion Resistance, ASTM D4060 C-17 Wheel, 1,000 gm load, 1,000 cycles	27 mg loss
8.	Potlife @ 70 F	10 – 15 minutes
9.	Gloss (ASTM D523) 60°	90
10.	Coefficient of Friction (ASTM D2047)	>0.6

PART 3 - INSTALLATION

3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.02 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

2. Moisture Testing: Perform tests recommended by manufacturer and as follows.

   a. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
   b. If the relative humidity exceeds 75% then Dur-A-Flex/Sherwin-Williams Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.

3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.

4. Mechanical surface preparation

    a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-4 as described by the International Concrete Repair Institute.
    b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
    c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
    d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations. Refer to Dur-A-Flex Joint Guidelines.

5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufacturers recommendations.

3.03 APPLICATION

A. General

1. The system shall be applied in three distinct steps as listed below:

    a. Substrate preparation
    b. Priming
    c. Broadcast coat application with chip broadcast
    d. Topcoat application

2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.

3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.

4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.

5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer

1. The primer shall be pigmented ACCELERA mixed per the manufacturer's instructions.

2. The primer shall be applied by 1/8" V-notched squeegee and cross rolled with a 3/8" nap roller at the rate of 115 SF/kit.

C. Broadcast Coat

1. The broadcast coat shall be applied as a single broadcast system as specified by the Architect.

2. The broadcast coat shall be comprised of two components: a resin, and hardener as supplied by the Manufacturer and mixed per manufacturer instructions.

3. The hardener shall be added to the resin and thoroughly mixed by suitably approved mechanical means.

4. The broadcast coat shall be applied over horizontal surfaces using a 3/16" V-notched squeegee and cross rolled with a 3/8" nap roller at the rate of 75 SF/kit.

5. Chips shall be broadcast to excess into the wet material, Macro chips at the rate of 0.1 lbs/sf, and Micro chips at the rate of 0.15 lbs/sf.

6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

7. Scrape the floor with a trowel or floor scraper. Sweep and vacuum the floor again.

D. Topcoat

1. The grout coat shall be comprised of ACCELERA resin and hardener mixed per the manufacturer's instructions.

2. The grout coat shall be flat squeegee applied and cross rolled with a 3/8" nap roller with a coverage rate of 65 SF/kit.

3. The finished floor will have a nominal thickness of 44 mils.

3.04 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:

a. Temperature
   1) Air, substrate temperatures and, if applicable, dew point.
b. Coverage Rates
   1) Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.05 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 096800 – CARPETING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

1. Carpeting in rooms and spaces designated on drawings.
2. Rubber base as required by the work.
3. Carpet accessories as required by the work.
4. Substrate preparation as required by the work.

1.02 RELATED WORK

A. Related work specified in other sections of the specifications.

1. Section 096519 - Resilient Floor Tile.

1.03 CONTRACT DOCUMENTS

A. Applicable provisions of the "Conditions of the Contract" and the General and/or Supplementary Conditions shall govern all work under this section.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications:

1. A minimum of three years experience.
2. Successfully completed projects of similar magnitude.

B. Accessibility Requirements:

1. Floor surfaces shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

1.05 SUBMITTALS

A. Comply with requirements of Section 013300 – Submittal Procedures.

B. Manufacturer’s product data, installation and maintenance instructions for all components of the work.

C. Shop Drawings:

1. Carpeted areas shall include the entire area of the room or space, recesses, closets, and similar areas or as indicated on finish floor plans.

2. Shop drawings shall indicate a working layout for each area showing seam locations, pattern of carpet, colors, trim or edge strips, and other pertinent details.

3. No carpet shall be installed before approvals have been received.

D. Samples:

1. Submit two samples of each of the following for approval:

a. Carpet: 12" x 12" each type, pattern, and color.
b. Rubber base or other accessories: Manufacturer's standard sample sizes.

E. Certificates: Prior to shipment of materials, submit to the Architect for approval certificates signed by the manufacturer attesting compliance with specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. All carpeting shall be delivered to the job in the original mill wrappings with each roll having its register number properly marked thereon.

B. Adhesives, solvents, and the like shall be delivered to the job in the manufacturer's original unopened containers, clearly marked.

C. All materials shall be stored under cover in clean, dry, well ventilated spaces immediately after delivery to the job. Any material which becomes damaged or soiled and, in the opinion of the Architect, cannot be repaired, will be replaced with new specified material at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All carpeting shall be first quality. No "seconds" or "imperfects" shall be installed.

B. All carpet shall be Class I and shall have minimum critical radiant flux of not less than .45 watts/sq. cm.

C. All Broadloom carpeting shall be "Constellation-Ecoworx Performance Broadloom" as manufactured by "Shaw Contract Commercial Carpets" or approved equal, of color to be selected by the Architect from the manufacturer's standard line.

Product Type: Performance broadloom
Size: Broadloom 12 foot
Construction: pattern loop
Dye Method: solution & yard dyed
Fiber Product: 100% eco*solution q® nylon – 55% solution dyed/45% space dyed
Protective Treatment(s): SSP® Shaw soil protection
Primary Backing: SYNTHETIC
Secondary Backing: Ecoworx performance broadloom
Gauge: 1/10
Face Weight: 26 oz.
Stitches per inch: 09.83
Finished Pile Thickness: 0.120
Average Density: 7,800 ozs./yd3
Pattern Repeat: 13/32"W X 6 29/32"L
Flammability: ASTM E-648 flooring radiant panel class I, ASTM E-662 NBS smoke chamber less then 450

Electrostatic Propensity: less than 3.5 KV, permanent conductive filament
Warranty: lifetime commercial limited warranty for ecosolution q sd nylon, lifetime commercial limited warranty for Ecoworx performance broadloom backing system
Recommended Installation: full spread Shaw 3500 or Shaw 3600 adhesives
Post Consumer Recycled Content: 0
Post Industrial Recycled Content: 9.7
Green Label Certification #: 59269968
Green Label Plus Certification #: GLP9968

D. All carpet tile shall be “Constellation-Tile” as manufactured by "Shaw Contract Commercial Carpets" or approved equal, of color to be selected by the Architect from the manufacturer’s standard line.

Product Type: carpet tile
Size: 24” x 24”
Construction: loop
Dye Method: solution & yarn dyed
Fiber Product: 55% ECO SOLUTION Q PREMIUM BRANDED NYLON-45% YARN DYED BCF NYLON
Protective Treatment(s): antistatic, SSP® Shaw soil protection, florsept antimicrobial
Primary Backing: SYNTHETIC
Secondary Backing: Ecoworx®
Gauge: 1/10
Face Weight: 24 oz.
Stitches per inch: 09.83
Finished Pile Thickness: 0.099
Average Density: 8,727 ozs./yd3
Pattern Repeat: N/A
Flammability: ASTM E-648 flooring radiant panel class I, ASTM E-662 NBS smoke chamber less than 450
Electrostatic Propensity: less than 3.5 KV, permanent conductive filament
Warranty: lifetime commercial limited warranty for Ecoworx tile backing system
Recommended Installation: monolithic
Post Consumer Recycled Content: 0
Post Industrial Recycled Content: 37.4
Green Label Certification #: 59269968
Green Label Plus Certification #: GLP9968

2.02 CARPET ACCESSORIES

A. Rubber Cove or Wall Base

1. Rubber cove or wall base shall be extruded and as manufactured by Roppe Corporation or equal. It shall be constructed of first quality materials, properly vulcanized, and shall be smooth and free from imperfections which detract from its appearance. The base shall conform fully to the requirements of U.S. Federal Specification SS-W-40a, Type I Rubber. All cove base shall be of the straight Style A, with a height of 4” (101.6 mm), in lengths continuous coil (1.22 m), in the color stated (see No. 4 below), and of 1/8” (3.175 mm) thickness.

2. Height: 4”

3. Thickness: 1/8” gauge.

4. Color: as may be detailed in the finish floor plans or as selected by Architect.

B. Rubber Carpet Edge Guard: shall be by Roppe, or equal. Colors as selected by Architect. Provide

edge type as follows:

1. Carpet to Vinyl: Roppe #50 tile/carpet joiner or equal.

2. Carpet Termination Reducer: Roppe #38 or #39, or equal. Glue down carpet edge as required.

3. Coordinate with door schedule (if included) and any metal thresholds that may be indicated under that component of the work.

C. Rubber Stair Nosing: Roppe #13 or #14 single flange carpet stair nosing as required or equal.

D. Adhesive: Water-based, water resistant and non-staining as recommended by carpet manufacturer to comply with flammability and VOC requirements for installed carpet.

E. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for use in taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams. Shaw recommends the use of Shaw 3500 or 3600 (AATCC174) adhesives or equivalent adhesives, which have been formulated with a higher solids content and will perform adequately with the Eco Broadloom backings.

F. Leveling and Patching Compounds: Types as recommended by carpet manufacturer and as appropriate for compatibility with substrate.

2.03 OTHER ACCEPTABLE MANUFACTURERS

A. Collins and Aikman
B. Bentley/Prince Street
C. Interface
D. An equal approved by the Architect

PART 3 – EXECUTION

3.01 PREPARATION AND SUBFLOOR CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install carpet until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1. Dimensions supplied in these specifications and drawings are approximate. The Contractor shall carefully check dimensions and other conditions affecting his work in the field and shall be responsible for proper installation of carpet in areas designated.

2. Surfaces to receive carpet shall be thoroughly clean, smooth, free from irregularities, and dry; apply sealer recommended by carpet manufacturer to prevent dusting if required.

3. Contractor shall prepare floors to receive new flooring by washing, etching, sanding, or filling or other procedures as necessary for satisfactory installation.

B. Subfloor Moisture Conditions: Moisture emission rate of not more than 5 lbs./1000 sq.ft./24 hours where tested by anhydrous calcium chloride moisture test in compliance with CRI 104, with subfloor temperatures not less than 55ºF.

1. Contractor shall include in the base bid additional costs for any additional surface preparation work and materials required to install carpet relative to specific slab-moisture content.

C. Subfloor Alkalinity Conditions: A pH range of 5 to 9 when subfloor is wetted with potable water and pHydrion paper is applied.

D. Apply latex underlayment where required to correct subfloor. Fill concrete slab on grade control joints with latex or as recommended by manufacturer for proper substrate. Underlayment shall be steel troweled smooth to prevent marks showing through installed carpet. Substrate imperfections telegraphing through installed carpet will not be acceptable and shall be reason to remove.

E. Concrete floors must be sealed if dusting or powdering exists. **Do not use sweeping compounds as they may leave oily deposits.** The following floor sealers are suggested for concrete. Coordinate with manufacturers requirements for materials selected.

1. Shaw Contract 9050 Floor Sealer and Shaw 8550 Level Primer.

2. Kure-N-Seal-Sonneborn #0800 – Chemrex, Inc.

3. Spartan Cote Cure Seal Hardener – The Burke Group.

3.02 INSTALLATION

A. Carpeting shall be installed in accordance with the manufacturer's instructions and the best methods of the trade.

B. All surfaces to receive carpet shall be level, smooth, clean, and dry, in a finished condition suitable to receive carpet. The carpet contractor shall notify the Owner in writing of any and all conditions to the contrary or otherwise unsatisfactory. In an instance where the flooring Contractor is the Prime Contractor, this Contractor shall be responsible for all floor preparation unless otherwise indicated. The installation of carpet shall be an indication of his acceptance of the existing conditions. No carpet shall be installed before approval.

C. Broadloom carpet shall be installed with adhesive applied directly to the sub-floor. Where seams occur in carpeting, they shall be seam sealed and latex reinforced with a lifetime edge ravel warranty. Where edge of carpeting butts other flooring material, the edges shall be protected with rubber edge strip unless aluminum thresholds are otherwise indicated. Edging shall be anchored to concrete floors with adhesive.

1. Fit sections of carpet prior to application of adhesive. Trim edges and butt caps with seaming cement.

2. Apply adhesive uniformly to substrate in accordance with manufacturer’s instructions. Butt edges tight to form seams without gaps. Roll entire area lightly to eliminate air pockets and ensure uniform bond. All seams on vinyl backed carpet are to be chemically welded.

3. All patterned carpet shall have pattern aligned at seams.

D. Carpet tile shall be installed with pressure sensitive adhesive such as Shaw Contract 5000, 5100 or equal. A 3/8” foam paint roller may be used to apply the adhesive. Allow the adhesive sufficient open time so that it will not transfer to the back of the tile. **The adhesive must be allowed to dry completely before installing the carpet.** Installing into wet adhesive will result in a permanent bond and may cause carpet to bubble. **NOTE – A FULL SPREAD OF ADHESIVE IS REQUIRED.**

E. Roll entire installation with a 75# roller at completion.

F. On completion of installation, dirt, carpet scraps etc., must be removed from the surface of the carpet. The carpet must be cleaned with a beater type vacuum cleaner. Soiled spots or adhesive on the carpet shall be removed with the proper spot remove. Loose pieces of face yarn must be removed with sharp scissors.

G. Use plywood over the carpet when heavy objects are moved within 24 hours after installation. A non-staining building material paper must be placed over the carpet to protect it when additional construction activity is to take place that would soil or stain it. **Do not use plastic sheeting as it will trap moisture.**

3.03 MAINTENANCE

A. The carpet manufacturer shall conduct a maintenance seminar for Owner's personnel.

B. Include a maintenance schedule and a list of necessary equipment required to maintain carpet.

3.04 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below packaged with protective covering for storage and identified with labels describing contents.

1. Carpet & Carpet Tile: Furnish quantity of material, in full width roll, equal to 2 percent of the amount of each carpet type installed, but not less than 100 sq. ft.

3.05 WARRANTY

A. Manufacturer must guarantee the following:

1. Abrasive Wear: Warrant that the carpet will lose no more than 10 percent by weight of pile face fiber during the lifetime warranty period when installed and maintained in accordance with manufacturer's procedures.

2. Static Protection: Warrant that the carpet will not generate static build-up in excess of 3.5KV during the lifetime warranty period as tested by AATCC test method 134.

3. Backing Integrity Delamination: Warrant that the secondary backing of the carpet will not delaminate from the face carpet for lifetime warranty period. Chair pads are not required whether the carpet is installed direct to the floor or by conventional tackless installation over cushion.

4. Edge Ravel: Warrant that under normal use the carpet will not edge ravel at seams or edge for the lifetime warranty period.

5. Tuft Bind: Warrant that the carpet will have an average face yard tuft bind of 20 pounds for the lifetime warranty period when tested using the ASTM D-1335-67 method. This portion of the warranty must protect against insufficient tuft bind, whether the carpet is dry or wet (as it might be during steam cleaning, hot water extraction, or as a result of a broken pipe or flood).

6. Pattern matching of seams (Broadloom only): Warrant that under normal use the carpet will pattern match within acceptable industry standards. Regardless of pattern repeat size, when installed in accordance with manufacturer installation guidelines.

7. Moisture Management (Broadloom Only): Warrant that under normal use, the carpet will keep liquid spills above the pre-coat layer for a minimum of 24 hours as tested under the British Spill Method; Part 2.

B. Warranty shall be from the manufacturer, written specifically for the project.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 098129 – SPRAYED ACOUSTICAL APPLICATIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The extent of sprayed on decorative/acoustical insulation is indicated on drawings.

1.02 QUALITY ASSURANCE:

A. Provide Portland Cement-Vermiculite material which has been tested to and achieved the following results:

Property	Test Method	Value
Asbestos Content	EPA 400/4M-82-020	No Asbestos No Mineral Fiber
Density	ASTM E 605	41 lbs./cu.ft.
Compressive strength	ASTM E 761	300 psi.
Bond Strength	ASTM E 736	5,000 lbs./sq.ft.
Surface burning characteristics	ASTM E 84	0 Flame Spread 0 Smoke Developed
Sound absorption	ASTM C 423	0.50 NRC @ 1/2" thick 0.60 NRC @ 1" thick
Toxicity	University of Pittsburgh Toxicity Test	LC_{50} > 300 grams
Combustibility	ASTM E 136	Non-Combustible
Hardness	ASTM D 2240	70

B. Provide testing results and procedures that have been certified by Cedar Knolls Acoustical Labs, or other accredited independent testing laboratories. Thickness of test samples must be determined and reported by acoustical laboratory. Nominal thicknesses are not acceptable unless peak thicknesses are also reported. Edges of acoustical test samples must be sealed with a wood or metal frame. Taping of edges is unacceptable.

1. NRC not less than 0.60 at 1 inch thickness and coefficient not less than 0.35, (+ or – 0.01), at 250 Hz. Conduct testing on solid backing with no air gap and sealed edges. Taping of edges is unacceptable.

C. Installer: Licensed by manufacturer.

D. Control Sample: Prior to installation of final coat, apply an area of 50 sq. ft. in presence of Architect, for approval of finish texture, as selected from samples.

1.03 SUBMITTALS:

A. Submit manufacturer's installation instructions, test data substantiating compliance with quality assurance.

B. Submit 12-inch square sample of sprayed on insulation showing texture variations for approval. Resubmit as required until approved. All samples must be certified by manufacturer that they are representative of the texture, which was acoustically tested in supporting acoustical test reports.

C. Submit test reports from all suppliers showing material to be 100% free of asbestos, mineral fibers, polystyrene and cellulose.

D. Submit certification of applicator licensing.

E. Submit acoustical test data for specified finish.

1.04 MATERIAL HANDLING:

A. Keep material dry until ready for use.

1.05 WARRANTY:

A. Manufacturer shall warrant the material to be supplied, agreeing to repair/replace that which has flaked, dusted excessively, peeled or fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively as intended for a sound absorbent purpose; due to defective materials and not due to abuse, improper maintenance, unforeseeable ambient exposures, or other causes beyond anticipated conditions by manufacturer. The warranty period will be 10 years from date of substantial completion.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Materials shall be Acoustement 40 manufactured by Pyrok, Inc., Mamaroneck, N.Y. (914) 777-7070, or equal.

B. Color (Standard White, Standard Grey, or) shall be selected by the Architect.

C. Textures shall be Standard Texture or Semi-Smooth finish as selected by Architect.

D. Thickness shall be nominally 1/2 inch.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION:

A. Examine all substrate and conditions.

B. Assure substrate is free of oil, grease, dirt, paint, or other matter which would impair bond or install metal lath as recommended by the manufacturer.

C. Do not proceed until said substrate and conditions are acceptable.

D. Prepare substrate by filling voids and cracks and offsets, remove projections that result in

telegraphing presence of imperfections.

E. Prime substrate with primer or bonding agent as recommended by the manufacturer.

F. Do not apply insulation material when temperature is below 44 degrees F (ambient), or substrate is below 40 degrees F.

G. Mask all adjoining surfaces in order to minimize damage from overspray.

H. Provide ventilation if required, and avoid excess drying rates.

I. Provide tarps or temporary enclosures as necessary to confine operations.

J. Perform all patching and repairing of insulation required to be done due to cutting, etc., by other trades.

3.02 APPLICATION:

A. Apply in accordance with manufacturer's printed instructions using any rotary-stator plastering pump or other spray equipment approved by the manufacturer.

B. Install to thickness indicated or thickness required to achieve NRC specified.

C. Ensure that texture and color are all as per control sample.

3.03 CLEANING AND PATCHING:

A. Remove overspray and fall out material immediately upon completion of the work in each area. Clean surfaces to remove evidence of soiling. Repair or replace damaged work surfaces to acceptable conditions.

B. Coordinate work with other work, to minimize possibility of damage to insulation resulting from performance of subsequent work. As other units of work are completed in each area, patch damaged areas or surfaces of insulation by overspraying to match original installations, or by patching procedures as required to provide acceptable results.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 098413 – ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all labor, materials, equipment and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings as specified herein, including, but not limited to, the following:

1. New sound-absorbing and sound-diffusing acoustical panels of size and shape shown on the drawings and/or specified herein.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. Architectural Woodwork Institute (AWI):

1. Quality Manual, 8th Edition.

C. ASTM International (ASTM):

1. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E 413 - Classification for Rating Sound Transmission.
4. ASTM E 795 - Practices for Mounting Test Specimens during Sound Absorption Tests.

D. Underwriter's Laboratory (UL):

1. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.03 SYSTEM DESCRIPTION

A. Furnish a system of sound-absorbing and sound-diffusing panels for reducing sound energy levels and improving the hearing environment.

B. Absorber Panels: Wall and ceiling mounted impact resistant polyhedrons; sound absorbing throughout audio spectrum; fabric wrapped.

C. Small Diffuser Panels (Type I – less than 24 sq. ft. in size): Wall mounted; impact resistant cylindrical section with two faceted ends or offset pyramidal shape; fabric wrapped. (Color and pattern as selected from manufactured standards)

D. Large Diffuser Panels (Type II – greater than or equal to 24 sq. ft. in size): Wall mounted; impact resistant cylindrical section with two faceted sides or offset pyramidal shape; sound absorbing material mounted on rear surface; fabric wrapped. (Color and pattern as selected from manufactured standards)

E. Ceiling Diffusers: Ceiling mounted; impact resistant cylindrical section with two faceted sides or

offset pyramidal shape; white finish.

F. Mounting Hardware:

1. Wall mounting (absorbers and diffusers): Four corner support, designed to allow panels of same size to be interchanged. NOTE: 2” clearance above top of absorbers and diffusers needed for proper mounting.

2. Ceiling mounted (absorbers and diffusers): Four corner hook suspended by wire to ceiling; lay-in hardware for ceiling grid; (minimum frame width 15/16”); direct ceiling mounting hardware.

G. Acoustical Performance Requirements:

1. Sound absorption coefficients, measured with a Type A and Type E-400 mounting, according to ASTM E795 (if applicable) or according to application mounting method, determined by ASTM C423:

2. Sound Transmission Class (STC), determined according to ASTM E90 and ASTM E413: Type I convex ceiling diffuser panel, 4’ x 4’; STC 23; Type I pyramidal ceiling diffuser panel, 4’ x 4’; STC 22.

1.04 SUBMITTALS

A. Shall comply with the requirements of Section 013300 and with the requirements listed below.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Provide test results by certified independent testing laboratory indicating compliance with performance requirements.
2. Rated capacities, construction details, material descriptions, dimensions of individual components, profiles, and finishes.
3. Delivery, storage, handling, and installation instructions and recommendations.
4. Maintenance instructions and recommendations

C. LEED Submittals: (when applicable)

1. Manufacturer's certificate indicating that composite wood products and adhesives contain no added urea formaldehyde.

D. Shop Drawings:

1. Include fabrication and installation details. Distinguish between factory and field work.
2. Include plans, elevations, sections, attachments and work by other trades.
3. Include wiring diagrams when applicable.

E. Verification Samples:

1. Acoustical Wall Panel: 12” x 12” sample.
2. Mounting hardware, including fasteners.
3. Exposed Finishes and Finish Materials: Not less than 8 by 10 inches, for each type, color, pattern, surface and material selected.

F. Quality Control Submittals:

1. Manufacturer’s Installation Instructions.

G. Contract Closeout Submittals:

1. Operation and Maintenance Data: For adjusting, repairing and replacing components and accessories.
2. Warranty: Submit manufacturer's warranty.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain all products from a single manufacturer through one source providing a comprehensive material and installation package.

B. Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.

C. Installer Qualifications: Experienced in installation of the work of this section and acceptable to the manufacturer.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and installation workmanship.

1. Finish areas designated by Architect including shims, sealants, and accessories.
2. Provide full size units, if accepted, units may remain as part of the completed work.
3. Do not proceed with remaining work until workmanship is approved by Architect.
4. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.

B. Handle and install materials to avoid damage.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.

B. Environmental Requirements: Install panels after all mortar, wet and dust producing trades have completed their work and wall and ceiling surfaces have been finished.

C. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.

1. Coordinate locations of electrical junction boxes.

D. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08 WARRANTY

A. Special Warranty for Acoustic Room Components: Manufacturer's written warranty indicating

manufacturer's intent to repair or replace panels that fail in materials or workmanship. Failures are defined to include, but are not limited to, the following:

1. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
2. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
3. Failure of unit to perform acoustically in accordance with manufacturer's published data.
4. Sound-Absorbing and Sound-Diffusing Panels Warranty Period: 5 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturer: Wenger Corporation, including all Wenger, J.R. Clancy and GearBoss product brands. Wenger Corporation, which is located at: 555 Park Dr.; Owatonna, MN 55060; Toll Free Tel: 800-4WENGER (493-6437); Tel: (507) 455-4100; Fax: (507) 455-4258; Email: request info (info@wengercorp.com); Wenger Corporation - Syracuse, which is located at 7041 Interstate Island Road, Syracuse, NY 13209; Toll Free Tel: 800-836-1885; Tel: (315) 451-3440; Email: request info (JRCinfo@wengercorp.com); Web: https://www.wengercorp.com.

2.02 SUBSTITUTIONS

A. The materials and products of the manufacturer listed above are approved as base bid for this project. All bids shall be submitted on the base bid products and materials. Proposed “write in” or voluntary alternates will not be considered in determining the low bid or the award of the contract.

B. Materials or products of another manufacturer will not be considered unless approved by addendum prior to the receipt of bids. The burden of demonstrating the merit of the proposed substitute is on the proposer. The proposer shall be prepared to supply the specified material or products from the specified supplier if the proposed substitute is not accepted.

C. Bidders wishing to submit substitutes shall make written request to the specifying authority at least ten (10) days prior to bid opening. Such requests must include adequate information to demonstrate precise functional equivalence to the base bid products and materials.

D. Final approval of the substitute shall be determined at the time of job completion. Failure to provide precise functional equivalence may result in removal of the substitute and installation of approved product at contractor’s expense.

E. If the specifying authority approves the proposed substitute prior to bid opening, approval will be set forth in an addendum. Bidders shall not rely upon approvals made in another manner. Bid prices based upon substitute products shall be identified separately.

F. The materials, products and equipment in the bidding documents establish the required standard of function, dimension, appearance and quality to be met by any proposed substitute.

G. Bidders requesting approval of a substitute must provide proof of an acoustical evaluation completed for the space where the panels are specified. The acoustical evaluation must show the acoustical effects of both sound absorbing panels and sound diffusing panels.

H. Bidders requesting approval of a substitute must include test reports from an accredited independent laboratory showing one-third octave band sound absorption coefficients of the production run of panels tested with specified mountings, Type A, Type E-400, whichever is applicable. Noise reduction coefficient (NRC) data alone are not acceptable. Octave band TL data

are not acceptable.

2.03 TRADITIONAL ACOUSTIC PANEL SERIES

A. Basis of Design: Provide a system of acoustical panels, as manufactured by Wenger Corporation, that absorb or diffuse sound in a configuration designed to reduce excess sound energy levels and improve sound distribution throughout the space.

B. Performance Requirements: Provide sound absorbing and sound-diffusing panels meeting requirements with the following characteristics:

1. Wall Panel Mounting Types for Acoustical Performance Characteristics according to ASTM E 795, with measurements determined according to ASTM C 423:
   a. No air space.

2. Ceiling Diffuser Panel Mounting Types for Acoustical Performance Characteristics according to ASTM E 795, with measurements determined according to ASTM C 423:
   a. No air space.
   b. E-150: 6 inches air space.
   c. E-400: 16 inches air space.

C. Wall and Ceiling Absorber Panels: Manufacturer's standard panel, with fabric covering laminated to front face of rigid glass-fiber board, with chemically hardened edges, with the following characteristics:

1. Basis of Design Product: Wenger Wall Absorber Panel and Ceiling Absorber Panel.

2. Absorber Panel Size: Width and length indicated on the Drawings.

   a. Thickness: 2 inches.
   b. Thickness: 3 inches.
   c. Thickness: 4 inches.

3. Fabric Covering: Guilford of Maine Acoustical Fabric, Style – Anchorage, FR701 or Whisper as selected by Architect.

4. Wall Panel Mounting Method: Metal wall bracket with panel-mounted z-bracket.

5. Ceiling Panel Mounting Method:

   a. Direct mount with brackets attached to panel back.
   b. Wire suspension from brackets attached to panel back.

6. Acoustical Performance, 2 inches thick, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

   a. 125Hz = 0.50.
   b. 250Hz = 0.96.
   c. 500Hz = 1.27.
   d. 1000Hz = 1.27.
   e. 2000Hz = 1.23.
   f. 4000Hz = 1.18.

7. Acoustical Performance, 3 inches thick, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

a. 125Hz = 0.65.
b. 250Hz = 1.10.
c. 500Hz = 1.31.
d. 1000Hz = 1.23.
e. 2000Hz = 1.20.
f. 4000Hz = 1.09.

8. Acoustical Performance, 4 inches thick, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

a. 125Hz = 0.84.
b. 250Hz = 1.17.
c. 500Hz = 1.34.
d. 1000Hz = 1.32.
e. 2000Hz = 1.25.
f. 4000Hz = 1.20.

D. Convex Wall Diffuser Panels: Acoustically-configured, polycylindrical convex molded thermoplastic panel, 0.125 inch thick, width and length indicated, and with the following characteristics.
1. Basis of Design Product: Wenger Type I Convex Wall Diffuser.
2. Fabric Covering: Manufacturer's standard, color and pattern as selected.
3. Wall Panel Mounting Method: Metal wall bracket with panel-mounted z-bracket.
4. Sound Transmission Class (STC): ASTM E 90 and ASTM E 413: 23.
5. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

a. 125Hz = 0.18.
b. 250Hz = 0.18.
c. 500Hz = 0.13.
d. 1000Hz = 0.10.
e. 2000Hz = 0.12.
f. 4000Hz = 0.16.

E. Convex Ceiling Diffuser Panels: Acoustically-configured, polycylindrical convex molded thermoplastic panel, 0.125 inch thick, and width and length indicated.

1. Basis of Design Product: Wenger Convex Ceiling Diffuser Panels.
2. Finish: Manufacturer's standard textured white.
3. Ceiling Panel Mounting Method:

a. Direct mount with brackets attached to panel back.
b. Wire suspension from brackets attached to panel back.
c. Lay-in ceiling grid clip. All lay-in ceiling panels include safety cable attachment to permanent ceiling grid in all four corners of ceiling panel.

4. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

a. 125Hz = 0.20.
b. 250Hz = 0.11.
c. 500Hz = 0.07.
d. 1000Hz = 0.04.
e. 2000Hz = 0.09.
f. 4000Hz = 0.21.

F. Convex Wall Diffuser/Absorber Panels: Acoustically-configured, selectively sound-absorptive

polycylindrical convex molded thermoplastic panel, 0.125 inch thick, width and length indicated, with sound attenuation board adhered to internal surface of panel.

1. Basis of Design Product: Wenger Type II Convex Wall Diffuser Panels.
2. Fabric Covering: Manufacturer's standard, color and pattern as selected.
3. Wall Panel Mounting Method: Metal wall bracket with panel-mounted grooved button.
4. Sound Transmission Class (STC): ASTM E 90 and ASTM E 413: 23.
5. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

    a. 125Hz = 0.34.
    b. 250Hz = 0.27.
    c. 500Hz = 0.14.
    d. 1000Hz = 0.11.
    e. 2000Hz = 0.11.
    f. 4000Hz = 0.19.

G. Pyramidal Ceiling Diffuser Panels: Acoustically-configured, offset pyramidal molded thermoplastic impact-resistant panel 0.125 inch thick, length and width indicated.

1. Basis of Design Product: Wenger Pyramidal Ceiling Diffuser.
2. Finish: Manufacturer's standard textured white.
3. Ceiling Panel Mounting Method:

    a. Wire suspension from back-mounted brackets.
    b. Lay-in ceiling grid clip. All lay-in ceiling panels include safety cable attachment to permanent ceiling grid in all four corners of panel.

4. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches unit, Mounting Type A.

    a. 125Hz = 0.27.
    b. 250Hz = 0.18.
    c. 500Hz = 0.09.
    d. 1000Hz = 0.06.
    e. 2000Hz = 0.03.
    f. 4000Hz = 0.00.

H. Quadratic Ceiling Diffuser Panel: Acoustically diffusing panel designed in accordance with quadratic theory with multiple wells of engineered depth in a molded thermoplastic panel, 48 by 48 inches by 0.125 inch thick.

1. Basis of Design Product: Wenger Quadratic Ceiling Diffuser.
2. Finish: Manufacturer's standard white.
3. Ceiling Panel Mounting Method: Lay-in ceiling grid. All panels include safety cable attachment to permanent ceiling grid in all four corners of panel.
4. Unit Weight: 35 lb.
5. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 96 inches unit, Mounting Type E-400.

    a. 125Hz = 0.36.
    b. 250Hz = 0.54.
    c. 500Hz = 0.59.
    d. 1000Hz = 0.43.
    e. 2000Hz = 0.24.
    f. 4000Hz = 0.19.

I. Fabric Facing Material: 100 percent woven plain weave polyester 2-ply, with the following characteristics:

1. Light Fastness: AATCC 16, Option 3: 40 hours.
2. Fastness to Crocking: AATCC 8: #4 Wet & Dry.
3. Flammability: ASTM E 84, Class A or 1.
4. Basis of design product: Guilford of Maine, FR-701.

J. Airborne Noise Reduction: Provide acoustical panels in layout designed by computer simulation based on Fitzroy formulas to provide the following sound reduction:

1. Band Rehearsal: _____ dB +/- 0.5dB.
2. Orchestra Rehearsal: _____ dB +/- 0.5dB.
3. Choral Rehearsal: _____ dB +/- 0.5dB.

K. Reverberation Time: Provide acoustical panels in layout designed by computer simulation based on Fitzroy formulas to provide the following reverberation times and amount of variability available in each room:

1. Band Rehearsal: _____ +/- 0.2 seconds. Degree of change: _____ seconds
2. Orchestra Rehearsal: _____> +/- 0.2 seconds. Degree of change: _____ seconds
3. Choral Rehearsal: _____ +/- 0.2 seconds. Degree of change: _____ seconds

L. Fire-rating: The fully assembled product, as installed, shall meet Class A fire protection. Test results for flame spread and smoke developed shall be provided upon request. Individual component level fire test data is not sufficient to meet Class A fire protection requirements and shall not be accepted.

All diffuser panels constructed of Class A materials (NFPA 101 Life Safety Code Requirements for Class A Interior Finishes are: Flame Spread 0-25, Smoke Developed 0-450).
All diffuser panels will be made of recyclable plastic (#Type 3).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with installation only after correction of unsatisfactory conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install manufactured units in accordance with manufacturer's recommendations, approved

submittals, and in proper relationship with adjacent construction.

B. Wall panel installation, using metal “Z” clip fasteners. Spacing and quantity shall be in accordance with the manufacturer’s recommendations.

C. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

D. Upon completion of the installation, the Contractor shall remove and vacuum clean all debris.

3.04 FIELD QUALITY CONTROL

A. Inspect installed work to verify compliance with requirements.

1. Verify that HVAC work and electrical work complies with manufacturer's submittals and written installation requirements.
2. Perform installation and startup checks as recommended by manufacturer.
3. Prepare inspection reports and submit to Architect.

3.05 CLEANING AND PROTECTION

A. Repair or replace defective work as directed by Architect upon inspection.

B. Clean surfaces. Touch up marred finishes or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.

C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 098413.11 – SOUND-ABSORBING WALL PANELS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all labor, materials, equipment and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings as specified herein, including, but not limited to, the following:

1. New sound-absorbing wall panels, custom-fabricated and fabric-finished.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. Architectural Woodwork Institute (AWI):

1. Quality Manual, 8th Edition.

C. ASTM International (ASTM):

1. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E 795 - Practices for Mounting Test Specimens during Sound Absorption Tests.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Surface Burning Characteristics (ASTM E84):

a. Flamespread: 25 maximum.
b. Smoke Developed: 450 maximum.
c. Fire ratings for all fabric covered panels is based on testing of the panel wrapped with the standard in stock fabric, Guilford of Maine, FR 701 Style 2100.

1.04 SUBMITTALS

A. Shall comply with the requirements of Section 013300 and with the requirements listed below.

B. Product Data: Submit product data sheet, for specified products:

C. Shop Drawings: Submit shop drawings showing layout, edge profiles and panel components, including anchorage, accessories, finish colors and textures:

D. Samples: Submit selection and verification samples of finishes, colors and textures:

1. Acoustical Wall Panel: 12” x 12” sample.
2. Mounting hardware, including fasteners.

E. Test Reports: Certified test reports showing compliance with specified performance requirements.

1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain all products from a single manufacturer through one source providing a comprehensive material and installation package.

B. Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.

C. Installer Qualifications: Experienced in installation of the work of this section and acceptable to the manufacturer.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and installation workmanship.

1. Finish areas designated by Architect including shims, sealants, and accessories.
2. Provide full size units, if accepted, units may remain as part of the completed work.
3. Do not proceed with remaining work until workmanship is approved by Architect.
4. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

C. Handle and install materials to avoid damage.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.

B. Environmental Requirements: Do not install panels until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 - 80 degrees F and 35% MINIMUM RH and 55% MAXIMUM RH, respectively. All products constructed with wood or wood fiber content must be stored for at least 72 hours in the controlled environment specified herein prior to installation to allow the materials to stabilize.

C. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.

1. Coordinate locations of electrical junction boxes.

D. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08 WARRANTY

A. Special Warranty for Acoustic Room Components: Manufacturer's written warranty indicating manufacturer's intent to repair or replace panels that fail in materials or workmanship. Failures are defined to include, but are not limited to, the following:

1. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
2. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
3. Failure of unit to perform acoustically in accordance with manufacturer's published data.
4. Sound-Absorbing and Sound-Diffusing Panels Warranty Period: 5 years.

PART 2 - PRODUCTS

2.01 SOUND-ABSORBING WALL PANELS

A. Acceptable Manufacturer: Kinetics Noise Control, Inc.

1. Contact: PO Box 655, 6300 Irelan Place, Dublin, OH 43017; Telephone: (614) 889-0480; Fax: (614) 889-0540; E-mail: intsales@kineticsnoise.com; Web site: www.kineticsnoise.com.

2.02 SUBSTITUTIONS

A. The materials and products of the manufacturer listed above are approved as base bid for this project. All bids shall be submitted on the base bid products and materials. Proposed “write in” or voluntary alternates will not be considered in determining the low bid or the award of the contract.

B. Materials or products of another manufacturer will not be considered unless approved by addendum prior to the receipt of bids. The burden of demonstrating the merit of the proposed substitute is on the proposer. The proposer shall be prepared to supply the specified material or products from the specified supplier if the proposed substitute is not accepted.

C. Bidders wishing to submit substitutes shall make written request to the specifying authority at least ten (10) days prior to bid opening. Such requests must include adequate information to demonstrate precise functional equivalence to the base bid products and materials.

D. Final approval of the substitute shall be determined at the time of job completion. Failure to provide precise functional equivalence may result in removal of the substitute and installation of approved product at contractor’s expense.

E. If the specifying authority approves the proposed substitute prior to bid opening, approval will be set forth in an addendum. Bidders shall not rely upon approvals made in another manner. Bid prices based upon substitute products shall be identified separately.

F. The materials, products and equipment in the bidding documents establish the required standard of function, dimension, appearance and quality to be met by any proposed substitute.

G. Bidders requesting approval of a substitute must provide proof of an acoustical evaluation completed for the space where the panels are specified.

2.03 MANUFACTURED UNITS

A. HardSide Panels:

1. Thickness: 2 inches, or as indicated on the Drawings.

2. Size: As indicated on the drawings up to a maximum 48 inches x 120 inches panel.

3. Core: 2 inches thick fiberglass, 6 - 7 pcf (96 - 112 kg/m^3) density.

4. Edge Detail: Square hardened with a Class A hardening solution.

5. Facing: FR 701 Style 2100 by Guilford of Maine. Designer-selected fabrics must be approved by the panel manufacturer as acceptable quality for wrapping and covering core materials. Some fabrics are unstable, too stiff, or lack the weight and thread density for producing an acceptable finish product.

   a. Color: As selected by Architect from collection noted above or equal.

6. Sound Absorption (ASTM C423): Noise Reduction Coefficient as follows:

   a. 2 inches panel: 1.00, minimum.

7. Mounting Accessories: Z-clips.

2.04 FABRICATION

A. General: Treat fabric wrapped panels using heat shrink process to develop fully taut facing.

B. Wrap panel edges and return facing fabric 1 - 2 inches on back of panel. Secure fabric with adhesive applied to edges and back of panel only.

PART 3 - EXECUTION

3.01 MANUFACTURERS INSTRUCTIONS

A. Compliance: Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

1. Verify that stud spacing is 16 inches o.c., maximum, for panels installed over open studs.

2. Do not install panels until unsatisfactory conditions are corrected.

3.03 INSTALLATION

A. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.

B. Spacing and quantity of fasteners shall be in accordance with the manufacturer’s

recommendations.

C. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

D. Upon completion of the installation, the Contractor shall remove and vacuum clean all debris.

3.04 CLEANING AND PROTECTION

A. Follow manufacturer’s instructions for cleaning panels soiled during installation. Replace panels that cannot be cleaned to as new condition.

B. Keep site free from accumulation of waste and debris.

C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 099000 – PAINTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.02 DESCRIPTION

A. Work included: Paint and finish all new and existing interior and exterior surfaces related to the proposed work area including surface preparations.

1. Examine the specifications and drawings of all trades and thoroughly be familiar with all provisions regarding painted work included therein. Surfaces shown, noted, scheduled, or specified to receive painters' finish as part of the work of this section.

2. The painting subcontractor shall furnish, maintain, and remove when no longer required, all scaffolding, staging, and riggings required for this work.

1.03 RELATED WORK DESCRIBED ELSEWHERE

A. Shop Coats: Refer to specific project manual sections for shop coats on items such as structural steel, miscellaneous metal, custom hollow metal work, and similar items.

B. Pre-Finished Items: Refer to specific project manual sections for factory-finished, or installer finishes.

C. Related Sections:

1. Section 033000 – Cast-in-Place Concrete
2. Section 042000 – Unit Masonry
3. Section 051200 – Structural Steel Framing
4. Section 052100 – Steel Joist Framing
5. Section 053000 – Metal Decking
6. Section 055000 – Metal Fabrications
7. Section 055200 – Metal Railings
8. Section 062000 – Finish Carpentry
9. Section 081113 – Hollow Metal Doors and Frames
10. Section 092900 – Gypsum Wall Board
11. Section 260500 – Common Work Results for Electrical

1.04 REFERENCES

A. Steel Structures Painting Council (SSPC):

1. SSPC-SP 1 - Solvent Cleaning.
2. SSPC-SP 2 - Hand Tool Cleaning.
3. SSPC-SP 3 - Power Tool Cleaning.
4. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.
5. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
6. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.

7. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.
8. SSPC-SP11, Power Tool Cleaning to Bare Metal.
9. SSPC-SP12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating.
10. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.

B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

C. California Department of Public Health (CDPH):

1. CDPH v1.1-2010 and V1.2-2017

D. LEEDv4 EQ Credit: Indoor Environmental Quality-Low Emitting Materials.

1.05 SUBMISSIONS

A. General: Comply with requirements of Section 013300 – Submittal Procedures and as modified below.

B. Product Data:

1. Submit to the Architect a complete schedule of paint materials proposed to be furnished and installed under this section, including name of manufacturer and type of paint.

2. Submit Product Data for each paint product type as required to demonstrate compliance with the specified requirements including the following:

a. Product characteristics.
b. Surface preparation instructions and recommendations.
c. Primer requirements and finish specification.
d. Storage and handling requirements and recommendations.
e. Application methods.
f. Cautions for storage, handling and installation.

3. For information only, submit two copies of manufacturer’s specifications, including paint analysis and application instructions for each material. Indicate by transmittal that a copy of each manufacturer’s instructions has been distributed to the applicator.

C. Verification Samples: Submit three (3) 8 ½” x 11” paint strike offs of each paint color and paint type specified for color match verification. Identify each sample as to finish/ sheen, formula, color name, and color number.

D. Stain Samples: Submit three (3) 8 ½” x 10” wood samples of stain matching specified wood species and color for architect’s approval.

E. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC’s).

F. Only submit complying products based on project requirements (i.e. LEED). Paint application must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO).

G. USGBC LEED V4 Submittals (when applicable):

1. MRc2 Environmental Product Declaration Product Language: Products shall be selected with a preference to products that have product-specific environmental product declaration

documentation.

2. EQc2 Low Emitting Materials: The VOC content of all adhesives, sealants, paints and coatings in this Section shall not exceed the VOC limits established in Division 01 Sustainable Design sections.

1.06 WORK NOT INCLUDED

A. Do not include painting, which is specified under other sections.

B. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.

C. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this section except as may be specified herein.

D. Do not paint any moving parts of operating units, mechanical or electrical parts such as valve operators, linkages, sinkages, sensing devices, and motor shafts, unless otherwise indicated.

E. Do not paint over any required labels or equipment identification, performance rating, name or nomenclature plates.

F. Do not paint prefinished items, concealed surfaces, and finished metal surfaces unless indicated.

1.07 DEFINITIONS

A. The term “paint,” as used herein, means all coating systems materials including primers, emulsions, epoxy, enamels, stains, sealers, fillers, and other applied materials where used as prime, intermediate, or finish coats.

1.08 QUALITY ASSURANCE

A. Standards: Comply with standards specified in the section and as listed in Section 014219.

B. Qualifications of Manufacturers: Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Architect.

C. Qualifications of Applicators:

1. A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
2. Provide at least one person who shall be present at all times during execution of the work of this section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this section.
3. Provide adequate numbers of workman skilled in the necessary crafts and properly informed of the methods and materials to be used.
4. Minimum three years of experience in applying commercial coating systems similar to the materials specified.

D. Paint Coordination:

1. Provide finish coats, which are compatible with the prime coats used.

2. Review other sections of this specification as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
3. Upon request, furnish information on the characteristics of the specific finish materials to ensure that compatible prime coats are used.
4. Provide barrier coats over non-compatible primers, or remove the primer and re-prime as require
5. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coating supplied under other sections.
6. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors and sheens available and as specified herein.

E. Field Samples:

1. Before proceeding with paint application provide a mock-up for evaluation of surface preparation techniques and application workmanship, finish one complete surface of each color scheme required, clearly indicating selected colors, finish texture, materials, and workmanship.

    a. Finish surfaces for verification of products, colors and sheens.
    b. Finish area designated by Architect.
    c. Provide samples that designate primer and finish coats.
    d. Compatibility and Adhesion: Check after one week of drying and curing by testing in accordance with ASTM D3359; Adhesion by tape test. If coating system is incompatible, additional surface preparation up to and including complete removal may be required.
    e. Do not proceed with remaining work until the Architect approves the mock-up.

2. Sample areas, when accepted by the Architect, shall serve as a minimum standard for work throughout the entire project.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer’s original unopened packages and containers bearing manufacturer’s name and label and the following information:

1. Product name or title.
2. Product description (generic classification or binder type).
3. Federal Specification Number, if applicable.
4. Manufacturer’s stock number and date of manufacture.
5. Contents by volume, for pigment and vehicle constituents.
6. Thinning instructions.
7. Application and use instructions.
8. Surface preparation.
9. VOC Content.
10. Environmental handling.
11. Color name and number.

B. Storage:

1. Provide proper storage to prevent damage to, and deterioration of, paint materials.
2. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing. Storage area is to be kept neat and clean. Any damage to the storage area or surrounding occurring during its use for storage shall be repaired to its original state (Architect’s acceptance required). Remove all soiled or used rags, waste, and trash from the building every night and take every precaution to avoid damage of fire.
3. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Handling:

1. Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

D. Protection:

1. Use all means necessary to protect the materials of this section before, during, and after installation. Protect the work and materials of other trades. Remove, clean, restore to original condition any spatter, runs, drips, spillage, overspray on other materials not intended to be painted.

E. Replacement:

1. In the event of damage, immediately make all the repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.10 JOB CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results, as required to maintain surface and ambient temperatures above 50ºF for at least 24 hours before, during and for at least 48 hours after paint application. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Do not apply paint in snow, rain, fog, or mist, or when relative humidity exceeds paint manufacturer's recommended limits. Avoid painting surfaces while they are exposed to hot sun.

C. Lighting: Provide minimum 80 foot candle light level at mid-height of substrate surface.

1.11 EXTRA STOCK

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Amount: Upon completion of the work of this section, deliver to the Owner an extra stock equaling 1% of each color, type, and gloss of paint used on the work but not less than 1 gal (3.8 l) or 1 case, as appropriate.

C. Packaging: Tightly seal each container and clearly label with the contents and location used.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; ASD Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Email: request info specifications@sherwin.com; Web: www.swspecs.com. Local representative: Anthony Spanevello, Architectural Account Executive | Tel: (516) 406-0612 | Email: Anthony.M.Spanevello@sherwin.com; or Architect approved equal.

2.02 PAINT MATERIALS

A. Design is based on the use of paint products manufactured by Sherwin Williams. The materials of this manufacturer are named in the painting schedule. Equal products of other manufacturers

approved in advance by the Architect may be utilized.

B. General: Provide the best quality grade of the various types of coatings as regularly manufactured by paint materials manufacturers approved by the Architect. Materials not displaying the manufacturer's identification as a standard best-grade product will not be acceptable.

C. Durability: Provide paints of durable and washable quality. Do not use paint materials, which will not withstand normal washing, as required to remove pencil marks, ink, ordinary soil, and similar material without showing discoloration, loss of gloss, staining or other damage.

D. Colors and Glosses: Provide colors and glosses as specified or to match existing from manufacturer's full range of colors for each product indicated.

E. Paints and Coatings:

1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
2. For opaque finishes, follow manufactures product instructions for optimal color conformance.

F. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

G. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

H. Undercoats and Thinners: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer and use only the recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

I. Standards: Provide paint materials which meet or exceed the standards listed for each application in the Painting Schedule in Part 3 of this section.

1. All paint to be V.O.C. compliant. The VOC concentrations (in grams per liter) of the product shall comply with the U.S. EPA 40 CFR 59 Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. OTC as used in this Section refers to the Ozone Transmission Commission. OTC II has established the following VOC levels for Maryland, New York and Connecticut, United States. Products shall meet the following OTC II limits for VOC's when jobs are in these states.

a. Interior flat paints: 50 grams per liter or less, per gallon.
b. Interior enamels: 100 grams per liter or less, per gallon.
c. Interior stains: 250 grams per liter or less, per gallon.
d. Interior primers: 100 grams per liter or less, per gallon.
e. Rust preventive coatings: 250 grams per liter or less, per gallon.
f. Dry fog coatings: 150 grams per liter or less, per gallon.
g. Floor coatings: 100 grams per liter or less, per gallon.
h. Flats50 g/L
i. Non-Flats100 g/L
j. Primers Sealers and Undercoats100 g/L
k. Floor Coatings100 g/L
l. Concrete/masonry Sealer100 g/L
m. Rust Preventative Coatings250 g/L
n. Industrial Maintenance Coatings250 g/L

o. Stains, Exterior250 g/L
p. Wood Coating/Varnish/stain275 g/L
q. Zinc Rich Primers340

J. Application Equipment: For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint and as approved by the Architect.

K. Other Materials: All other materials, not specifically described but required for a complete and proper installation of the work of this section, shall be new, first-quality of their respective kinds, and as selected by the Contractor subject to the approval of the Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to installation of the work of this section, carefully inspect the installed work of all other trades and verify that such work is complete to the point where this installation may properly commence. Verify that painting may be completed in strict accordance with the original design and with the manufacturer's recommendations as approved by the Architect.

B. Do not begin installation until substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.02 SURFACE PREPARATION

A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

1. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's requirements and application instructions as approved by the Architect. Clean each surface to be painted prior to applying paint or surface treatment.
2. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
3. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
4. Remove oil and great with clean cloths and cleaning solvents of low toxicity and a flash point in excess of 38ºC (100ºF), prior to start of mechanical cleaning.
5. Remove all removable items, which are in place and are not scheduled to receive paint finish or provide surface-applied protection prior to surface preparation and painting operations.
6. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
7. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air,

surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.

8. Schedule the cleaning and painting in coordination with the Owner.

B. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

C. Block (Cinder and Concrete): Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75 degrees F (24 degrees C). The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

D. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

E. Cement Composition Siding/Panels: Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments.

F. Copper and Stainless Steel: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP 2, Hand Tool Cleaning.

G. Exterior Composition Board (Hardboard): Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard) must be cleaned thoroughly and primed with an alkyd primer.

H. Drywall - Exterior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds.

I. Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

J. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.

K. Plaster: Must be allowed to dry thoroughly for at least 30 days before painting unless the products are designed to be used in high pH environments. Room must be ventilated while drying; in cold, damp weather, rooms must be heated. Damaged areas must be repaired with an appropriate patching material. Bare plaster must be cured and hard. Textured, soft, porous, or powdery plaster should be treated with a solution of 1 pint household vinegar to 1 gallon of water. Repeat until the

surface is hard, rinse with clear water and allow to dry.

L. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow. Coordinate with paint specified and manufacturers requirements for appropriate preparation to receive paint specified.

1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials: SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure

water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.

10. Water Blasting, SSPC-SP12/NACE No. 5: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

M. Vinyl Siding, Architectural Plastics, EIFS and Fiberglass: Clean vinyl siding thoroughly by scrubbing with a warm, soapy water solution. Rinse thoroughly. Do not paint vinyl siding with any color darker than the original color unless the paint system features Sherwin-Williams VinylSafe technology. Painting with darker colors that are not Sherwin-Williams VinylSafe may cause siding to warp. Follow all painting guidelines of the vinyl manufacturer when painting. Only paint properly installed vinyl siding. Deviating from the manufacturer's painting guidelines may cause the warranty to be voided.

N. Stucco: Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments such as Loxon.

O. Wood: Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

3.03 INSTALLATION

A. General

1. Apply products in accordance with manufacturer’s instructions.
2. Secure color schedules before applying paint or finish. Tint primer and undercoat to the approximate shade of the finish coat.
3. Apply all materials under adequate illumination and as follows:

    a. Brush Application: Brush out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.
    b. Spray Application:

        1) Confine spray application to metal framework and similar surfaces where hand brushwork would be inferior.
        2) Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building of film thickness of two coats in one pass.

4. Allow sufficient drying time between coats. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.
5. Apply materials in sufficient quantity to insure complete coverage and hide. Provide and apply additional coats until paint film is uniform in finish, color, appearance, and coverage.

B. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.

C. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.

D. Apply coatings using methods recommended by manufacturer.

E. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

F. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

G. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

H. Completed work shall match the approved samples for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

3.04 STAIN APPLICATION

A. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of priming coat. After priming fill holes and imperfections in finished surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

B. Stain or seal wood required to be painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases and paneling.

C. When transparent finish is required, use spar varnish for back priming.

D. Back-prime paneling on interior partitions only where masonry, plaster, or other wet wall construction occurs on backside.

E. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

3.05 CLEANING AND PROTECTION

A. Cleaning:

1. Promptly remove spilled, splashed, or splattered paint on finish as work proceeds and upon completion.
2. Keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris during progress of work.
3. Upon completion of work, leave premises in neat and clean condition.

B. Protect finished coatings from damage until completion of project.

C. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

D. Completed work shall match the approved samples for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

3.06 PAINTING SCHEDULE

A. General: Painting required under this section is called for on the drawings. Paint types for specific surfaces, exterior and interior are as defined below:

Exterior Work			
Surface	**1st Coat**	**2nd Coat**	**3rd Coat**
Hollow Metal Doors & Frames (Note 3 & 4)	B or *	A	A
Exposed Miscellaneous Metal or Structural Steel (Note 3 & 4)	T or *	I	I
Steel Handrails & Steel Lintels (Note 3 &4)	T	I	I
Traffic Bearing Exterior Metals (Steel Ladders – Foot Traffic) (Note 3 & 4)	N	R	R
Aluminum (Note 4)	B	A	A
Wood, Visible Blocking, Plywood	C	D	D
Visible Metal Plaster accessories adjoining stucco	T	I	I
Concrete Block	E	F	F
Galvanized Metal (Note 4)	B	I	I
Concrete Walls	O	F	F
Interior Work			
Surface	**1st Coat**	**2nd Coat**	**3rd Coat**
Concrete Block	E	G	G
Plaster	M	G	G
Gypsum Drywall	M	G	G
Concrete Walls	O	G	G
Concrete Floors, light to moderate duty, (Note 1) 1st coat is a thin coat to prime	P	P	P
Concrete Floors, moderate to Heavy duty, no vehicular traffic (Note 1)	N	Q	Q
Concrete Floors (High Vehicle Traffic, Wet Environments) (Note 1)	N	U	R
Wood-Painted (Note 2 & 5)	C	G	G
Wood-Natural Finish (Note 5)	J	J	J
Wood-Stained Finish (Note 5)	V	S – 2 coats	J – 2 coats
Hollow Metal, Steel Handrails & Steel Stair Components (Note 3 & 4)	B or *	A	A
Exposed Structural Steel & Steel Joists (Note 3 & 4)	B or *	K or L	K or L
Galvanized Steel Floor or Roof Deck (Note 4)	B	K or L	K or L
Miscellaneous Metal (Note 3 & 4)	B or *	L	L
Steel Floor Deck (Diamond Plate etc.) (Note 3 & 4)	N	R	R
Galvanized Metal (Note 3 & 4)	B	A	A
Exposed Ductwork (Note 4)	B	K or L	K or L

*Shop Coat – See other sections of Project Manual

Note 1: Where non-skid properties are required, a non-skid additive shall be used. Apply per manufacturer's instructions. Confirm if required via Architect.

Note 2: This is for large exposed surfaces. Where paint is indicated on narrow recesses, or on visible surface of back-up supports or blocking, use flat enamel.

Note 3: Inspect shop coat and touch up prior to finish coat application to prevent finish coat contacting bare steel. All exposed structural steel is to be painted in finished areas as per schedule unless noted otherwise on the Contract Documents.

Note 4: Prior to priming and painting of exposed ductwork, galvanized steel, aluminum and other non-ferrous metals the Contractor shall clean bare metal with an oil and grease emulsifier (SIMPLE GREEN Heavy-Duty & All-Purpose Degreaser or equal). This product shall be ready to apply from the container. Careful surface preparation and cleaning is required. All surfaces shall be thoroughly clean and free from all grease, wax, oil, polish, loose paint, dirt or rust. Do not use mineral spirits, turpentine solvent or cleaners which will leave an oily residue. Apply clean and remove/rinse in accordance with manufacturer's instructions.

Note 5: For Wood Flooring finishes see Wood Flooring Specification Section included elsewhere in Division 09 of the Project Manual.

3.07 KEY TO PAINTS

* Shop coat: See other section of Project Manual.

A	S-W Pro Industrial DTM Acrylic Semi-Gloss, B66W01151 or S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-1150/2150 Series
B	S-W Pro Industrial Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series
C	S-W PrepRite® ProBlock® Interior-Exterior Latex Primer-Sealer, B51-600 Series
D	S-W A-100 Exterior Latex Low Sheen, A12W00151 or S-W SuperPaint Exterior Latex Low Lustre, A78-Series
E	S-W Pro Industrial Heavy Duty Block Filler (B42 Series)
F	S-W A-100 Exterior Latex Gloss, A08 Series or S-W SuperPaint Exterior Latex Gloss, A84-Series
G	S-W ProMar 200 Zero VOC Interior Latex Eg-Shel (B20-2600 Series) or Semi-Gloss (B31-2600 Series)
H	Not Used
I	S-W Pro Industrial Waterbased Alkyd Urethane Enamel Gloss (B53 Series)
J	Minwax Water-Based Polycrylic [for vertical applications only, no floors] or Minwax Oil-Modified Polyurethane (furniture, woodwork, cabinets, doors, hardwood floors)
K	S-W Pro Industrial™ Waterborne Acrylic Dryfall Flat (B42 Series)
L	S-W ProMar 200 Zero VOC Interior Latex Flat (B30-2600 Series)
M	S-W ProMar® 200 Zero V.O.C. Interior Latex Primer (B28 Series)
N	S-W Macropoxy 920 Pre-Prime (B58 Series)
O	S-W Loxon Concrete & Masonry Primer/Sealer (LX02 Series)
P	S-W Armorseal® Tread-Plex™ 100% Acrylic Water Based Floor Coating (B90 Series)
Q	S-W Armorseal® 8100 Water Based Epoxy Floor Coating Satin (B70-8160 Series)
R	S-W Hi-Solids Polyurethane 250 Aliphatic Polyurethane Semi-Gloss or Gloss (B65 Series)
S	Minwax Wood Finish, Water Based, Semi-Transparent, Color Stain
T	S-W Pro Industrial Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series
U	S-W Armorseal 650 SL/RC Self-Leveling/Recoatable Epoxy (B58 Series) or S-W High Performance Flooring System TBD (architect to confirm).
V	Minwax Water-Based Pre-Stain Wood Conditioner

END OF SECTION

DIVISION 09 – FINISHES

SECTION 099600.11 – HIGH PERFORMANCE COATINGS (SCRUBTOUGH)

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and application for high performance coatings as required for the complete performance of the work, and as shown on the Drawings and as herein specified.

B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:

1. Surface preparation.
2. Water-based two-component polyurethane-fortified paint finish system.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Section 033000 – Cast-in-Place Concrete
C. Section 042000 – Unit Masonry
D. Section 062000 – Finish Carpentry
E. Section 092900 – Gypsum Wall Board

1.03 REFERENCE STANDARDS

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. ASTM

1. ASTM D 1308, "Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes."
2. ASTM D 2486, "Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints."
3. ASTM D 2794, "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)."
4. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

C. Painting and Decorating Contractors of America (PDCA):

1. PDCA P5, "Benchmark Sample Procedures for Paint and Other Decorative Coating Systems."

D. South Coast Air Quality Management District (SCAQMD):

1. SCAQMD Rule #1168, "Adhesive and Sealant Applications," including most recent amendments."

1.04 SYSTEM DESCRIPTION

A. VOC: Coatings shall have 50 g/l of VOC's.

B. Fire Rating: Coatings shall be Type I or Class A fire-rated, ASTM E 84.

C. Scrub Test: Greater than 8000 cycles, ASTM D 2486.

D. Impact Resistance: Greater than 60 in/lbs, ASTM D 2794.

E. Chemical Resistance: 10 (test maximum) for all chemicals tested, ASTM D 1308.

F. Finish: 10 percent to 15 percent gloss at 60 degrees.

G. Stain Removal: 8 to 10 (test maximum) for all stains tested, four-hour Open Spot Test.

1.05 SUBMITTALS

A. General: Comply with requirements of Section 013300 and as modified below.

B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, manufacturer's product data and application instructions.

1. Submit written proof of approval by the manufacturer and written acknowledgement that equipment to be used is approved by finish system manufacturer.

C. Finish Samples:

1. Sample Card: Submit two sample cards indicating manufacturer's standard selection of finish colors.
2. Samples: Submit two 4 inch by 5 inch samples of cardboard with specified or selected finish colors.
3. Control Samples: Submit two samples of each finish color to ensure ability to reproduce selected finishes.

D. Quality Control Submittals: Submit letter from manufacturer stating that applicator has completed manufacturer's training program.

E. LEED Submittals: (When applicable) Submittals that are required to comply with requirements for LEED certification include, but shall not be limited to, the following:

1. Regional Materials: Provide product data for regional materials indicating location and distance from the Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Distance shall be within 500 miles of the Project Site. Include statement indicating cost for each regional material and, if applicable, the fraction by weight that is considered regional.

2. Low-Emitting Materials: Submit certification by the manufacturer confirming that products (i.e., adhesives, sealants, paints, coatings, etc.) meet or exceed the volatile organic compound (VOC) limits set by specific agencies or other requirements as outlined in LEED Green Building Rating System. VOC limits shall be clearly stated in the submittal.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of high performance coatings of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.

    a. Manufacturer to certify they make all materials in this Section.
    b. All materials within special coatings section including, but not limited to, finishes, and primers shall be supplied by one manufacturer.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Qualifications of Applicators:

1. Provide at least one person who shall be present at all times during execution of the work of this section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this section.

2. Provide adequate numbers of workmen skilled in the necessary crafts and properly informed of the methods and materials to be used.

3. Minimum three years of experience in applying commercial coating systems similar to materials specified.

D. Mock-Ups (Benchmarks): Prior to application of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of work.

1. Prepare a mock-up as per PDCA P5.

2. Apply minimum 100 square foot of finish system at location on the Project as directed by the Architect. Provide separate mock-up for each finish color.

3. If accepted, mock-up shall demonstrate minimum standard for the work. Mock-up may remain as part of the work.

E. Pre-Application Conference: Conduct pre-application conference in accordance with Project Meetings. Prior to commencing the application, meet at the Project site to review the material selections, application procedures, and coordination with other trades. Mock-ups shall be reviewed during the pre-application conference. Pre-application conference shall include, but shall not be limited to, the Contractor, the Applicator, manufacturer’s representatives, and any trade that requires coordination with the work. Date and time of the pre-application conference shall be acceptable to the Owner and the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Storage:

1. Provide proper storage to prevent damage to, and deterioration of, paint materials. Store paint materials at minimum ambient temperature between 50 degrees F and 80 degrees F, in a well-

ventilated area. Protect from freezing.

2. Store all materials in a single location approved by the Architect. Storage area is to be kept neat and clean. Any damage to the storage area or surrounding occurring during its use for storage shall be repaired to its original state (Architect's acceptance required). Remove all soiled or used rags, waste, and trash from the building every night and take every precaution to avoid damage of fire; take all precautionary measures necessary to prevent fire hazards and spontaneous combustion.

C. Replacements:

1. In the event of damage, immediately make all the repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

D. Maintenance Materials:

1. Extra Stock: Leave on premises, where directed by the Architect, not less than ten percent of each base coat color used.

2. Containers to be tightly sealed and clearly labeled for identification.

1.08 PROJECT CONDITIONS

A. Apply coating under following conditions:

1. Temperature of air and substrate is between 50 degrees F and 80 degrees F. Relative humidity shall be less than 50 percent.

2. Prevent wide temperature fluctuations that could cause moisture condensation on freshly coated surfaces.

3. Application areas shall be free of excessive dust.

B. Lighting: Maintain minimum 80 footcandles on surfaces to be coated.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes, unless moisture content of surfaces are below the following maximums:

1. Plaster and gypsum wallboard: 12 percent.

2. Masonry, concrete and concrete block: 12 percent.

3. Interior located wood: 15 percent.

1.09 PROTECTION

A. Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of other trades. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

C. Place cotton waste, cloths, and material that may constitute a fire hazard in closed metal containers and remove daily from site.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned, and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

1.10 WARRANTY

A. General: Refer to Section 017000 – Contract Closeout.

B. Special Warranty: The manufacturer shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials for a period of five years from date of Substantial Completion. This special warranty shall extend the one year period of limitations contained in the General Conditions.

C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Products: Products specified are those as manufactured by ICP Building Solutions Group. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by listed manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent. Equal products of other manufacturers approved in advance by the Architect may be substituted. Scuffmaster distributor (visit www.scuffmaster.com for a listing) or ICP at 800-898-0219 or fax 612-722-8853.

2.02 MATERIALS

A. LEED Requirements: (When applicable)

1. Regional Materials: Provide a minimum of 10 percent (based on cost) and an additional 10 percent beyond Credit MR 5.1 (total of 20 percent, based on cost), of building materials that are regionally extracted, processed, and manufactured.

2. Low-Emitting Materials: Use adhesives, sealants, paints, coatings, etc., that comply with the specified limits for VOC content when calculated according to SCAQMD Rule #1168. See LEED Green Building Rating System for VOC content limits.

B. Primer: Provide primer recommended by manufacturer for substrate. All surfaces must be primed prior to applying a Scuffmaster finish. See section 3.02 Preparation.

1. Concrete and Masonry: 100% acrylic block filler (if filling pores is desired). Provide manufacturer's recommended product if uniform base color with pores exposed is desired.
2. Factory Primed/Shop Primed Metal: Re-prime metal with suitable primer. Test primer for compatibility and adhesion.

3. Unprimed Metals: In accordance with the manufacturer's recommendations.

   a. Ferrous Metal: Use rust inhibitive primer. Test primer.
   b. Non-ferrous Metals: Chemically etch and apply bonding primer and/or use metal etching primer in accordance with manufacturer. Test primer for compatibility and adhesion.

4. New Gypsum Board:

    a. “Primemaster Primer/Sealer,” ICP Building Solutions Group.

5. Ceramic Tile and Glazed Block:

    a. “Primemaster Bonding Primer,” ICP Building Solutions Group.

6. Vinyl Wall Covering and Plastic: In accordance with the manufacturer’s recommendations. Apply bonding primer.

C. Finish System Components:

1. Finish Coat: Two-compartment polyurethane-fortified coating and cross-linker.

    a. “Scuffmaster ScrubTough,” ICP Building Solutions Group.

2. Miscellaneous Materials: Surface patching compounds and other materials necessary for application of finish system shall be of high quality and compatible with coating system.

2.03 EQUIPMENT

A. Spray or roll primers and base coats in accordance with manufacturer’s instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be applied, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

1. Verify that substrates are ready to receive work of this Section and are in accordance with coating manufacturer's requirements. Report any conditions that would adversely affect the appearance or performance of the coating systems.

2. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Applicator.

B. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

1. Start of painting will be construed as the applicator's acceptance of surfaces and conditions within a particular area.

C. Coordination of Work: Review other Sections in which primers are provided to ensure compatability of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify the Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. Protection: Mask adjacent surfaces to protect from overspray. Protect floors and other surfaces with drop cloths.

1. Remove items which are not to be coated from surfaces that are to be coated. Tag and protect removed items and store until re-installation. Re-install items after completion of coating application. Items which are not to be coated include, but shall not be limited to, operating hardware, electrical device plates, and factory-finished items.

2. Patch and repair substrates as specified in applicable specifications sections. Clean substrates. Remove dirt, grit, loose materials, grease, oil, temporary protective coatings, contamination, other foreign materials, etc. Sand with 100 grit or finer sand paper, spackle, putty, and caulk existing surfaces to produce smooth an uniform substrates. Spot-prime existing water-soluble stains with alcohol or oil-based stain killing primer. Touch-up painted or primed surfaces with compatible paint or specified primer.

B. Concrete: Remove high spots, fill holes and clean surfaces as specified in Section 033000 - Cast-In-Place Concrete. Allow new concrete to cure a minimum of 28 days prior to application of coatings.

C. Masonry: Tool joints and clean surfaces as specified in Section 042000 - Unit Masonry. Rinse off cleaning solutions and allow surface to dry. Allow new mortar to cure a minimum of 28 days prior to coating.

D. Ferrous Metals: Remove rust and mill scale. Wire brush or sand damaged or rusted areas to bright metal. Remove grease and other foreign materials with acetone or suitable cleaner. Touch-up damaged areas of shop primer.

E. Aluminum: Thoroughly clean with acetone. Abrade the surface, remove dust, chemically etch and/or apply a metal etching primer. Test for compatibility and adhesion. As an alternative, use a wash primer prior to the paint application.

F. Non-Ferrous Metals Including Stainless Steel & Brass: Clean with acetone. Heavy duty sanding in a criss-cross or jagged pattern is necessary. Chemically etch and/or apply a metal etching primer. Test for compatibility and adhesion.

G. Wood: Sand smooth and free of marks as specified in Section 062000 - Finish Carpentry. Wash sap spots and knots with denatured alcohol. When dry, cover spots and knots with two coats of shellac.

H. Plaster: Allow new plaster to cure a minimum of 28 days prior to coating.

I. Gypsum Board: Apply joint tape and compound to joints, fastener heads, dents, and surface flaws as specified in Section 092900 - Gypsum Wall Board. Sand smooth and flush with adjacent surfaces. Thoroughly clean sanded areas of dust.

J. Ceramic Tile and Glazed Block: Thoroughly clean off oil, wax, grease, and other residues. De-gloss by using a chemical etching process. In most cases the use of an etching cream is most effective. Consult ICP. Remove sanding dust with a clean, wet rag.

K. Vinyl Wall Covering: Comply with manufacturer’s written recommendations. Thoroughly clean and make sure there are no bubbles/blisters, make sure all edges and seams are well adhered.

L. Previously Painted Surfaces: De-gloss (if necessary) and re-prime previously painted substrates with manufacturer’s recommended primer.

3.03 APPLICATION

A. Applicator shall apply coatings in accordance with manufacturer's written instructions.

1. Closets and storage areas shall be finished inside in the same manner as adjoining rooms.
2. Finish HVAC registers and grilles and other items located in surfaces to receive coatings.

B. Apply as many primer coats as necessary to produce a uniform substrate appearance. Do not exceed manufacturer's recommended coverage rate. Allow to dry prior to application of subsequent coats.

C. Re-prime suction and hot spots on substrate prior to applying base coatings.

D. Over wood and gypsum board, sand primer with 100 grit or finer sand paper. Thoroughly remove dust from sanding with a clean, wet rag.

E. Spray or roll finish to completely cover primer and according to manufacturer's written instructions. Apply in a continuous, even film at manufacturer's specified coverage rate.

F. Apply each coat to a natural break point such as an edge or corner without stopping.

G. Finishes shall match approved benchmark samples and shall be free of runs, sags, holidays, and excessive irregularity/unevenness of pattern coat. Transitions between colors and/or other materials shall be sharp, clean and without overlaps.

3.04 INSPECTION

A. Request acceptance of each coat before applying succeeding coats.

B. Touch-up and repair unacceptable work.

C. Protect finished areas from damage.

3.05 CLEANING

A. Clean overspray and spills. Remove masking.

B. Repair damage to coatings and surfaces caused by clean-up activities.

3.06 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Applicator, that shall ensure that the high performance coatings shall be without damage at time of Substantial Completion.

3.07 COATING SCHEDULE

A. General: Scheduled number of coats is in addition to surface preparation specified above.

B. Substrate Type:

1. Primer: See manufacturer's Finish Data Sheet.
2. Coating: "Scuffmaster ScrubTough" polyurethane-fortified eggshell coating with cross-linker, ICP Building Solutions Group.

3.08 FINISH STYLE/COLOR SCHEDULE

A. See Finish Schedule for more information.

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 101100 – VISUAL DISPLAY UNITS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to the work of this section.

1.02 WORK INCLUDED

A. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

1. Porcelain Enamel Steel Markerboards and Chalkboards.
2. Vertical and Horizontal Sliding Units.
3. Tackboards.
4. Accessories.

1.03 REFERENCED STANDARDS

A. American Society for Testing Materials

1. ASTM-E 84 Standard Test Method for Surface Burning Characteristics for Building Materials.
2. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Wires, Profiles and Tubes.

B. Porcelain Enamel Institute

1. PEI-1002 Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.

C. GREENGUARD Certification from UL Environment

1. Meets GREENGUARD Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer shall be a firm engaged in the manufacture of visual display boards in the United States.

2. Manufacturer shall have a minimum of 5 years experience in the manufacture of visual display boards.

B. Regulatory Requirements: Conform to applicable code for flame/smoke rating in tackboards in accordance with ASTM-E 84.

C. Product Certifications: Provide GREENGUARD Gold certificate for markerboards, as applicable.

D. Operation and Maintenance: Include data on regular cleaning, stain removal, and precautions.

1.05 SUBMITTALS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

B. Shop Drawings: Provide shop drawings for each type of visual display board required.

C. Product Data: Provide technical data for materials specified. Include Material Safety Data Sheets, when applicable.

D. Samples and color charts: Provide Manufacturer's color charts and composition samples of face, core, backing and trim to illustrate finish, color and texture, where required.

E. Manufacturer's Instructions: Provide Manufacturer's installation instructions.

1.06 PROJECT CONDITIONS

A. Field measure prior to preparation of shop drawings and fabrication to ensure proper fit.

B. Comply with manufacturer's recommendations for climatizing area for interior moisture and temperature to approximate normal occupied conditions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delay.

B. Delivery: Deliver materials in original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.08 WARRANTY

A. Submit a "Life of the Building" warranty, stating that under normal usage and maintenance, and when installed in accordance with manufacturer's instructions and recommendations, Claridge porcelain enamel steel chalkboards and markerboards are guaranteed for the life of the building. Guarantee covers replacement of defective boards but does not include cost of removal or reinstallation.

B. Submit a standard warranty, stating when installed in accordance with manufacturer's instructions and recommendations, Claridge tackboards are guaranteed for one year against defects in materials and workmanship. Guarantee does not cover normal wear and tear, improper handling, any misuse, or any defects caused by vandalism or subsequent abuse. Guarantee covers replacement of effective material but does not include cost of removal or reinstallation.

C. Writing Surface Warranty Period: 10 years commending on Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Visual Display Board Manufacturer:
Claridge Products and Equipment, Inc., Contact: P.O. Box 910, Harrison, AR 72602;
Telephone: (870)743-2200; Fax:(870)743-1908;

E-Mail: claridge@claridgeproducts.com;
website: www.claridgeproducts.com.

B. The terminology used may include reference to the manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting competition.

C. Products used shall be those upon which the design is based or shall be equal products as approved in advance by the Architect.

D. All chalkboards and tackboards shall be by one manufacturer.

2.02 MATERIALS FOR MARKER BOARDS AND CHALKBOARDS

A. Writing Surface Face Sheet – Manufactured in accordance with Porcelain Enamel Institute's specification.

1. Shall be enameling grade cold rolled steel manufactured from a minimum of 30 percent post-consumer and post-industrial waste.

2. Enameling grade steel shall be coated with LCS³ Porcelain Enamel by Claridge Products and Equipment.

a. 3-Coat process shall include:

1) Bottom Ground Coat – 1.5 to 2.2 mils
2) Top Ground Coat – 2.0 to 2.8 mils
3) Top Cover (Color) Coat – 3.0 to 4.0 mils

3. Firing Temperature: Enamel shall be fired at lowest possible temperatures to reduce steel and porcelain stresses and achieve superior enamel and hardness.

4. Color: As selected by architect from manufacturer's standards. Color charts furnished on request. NOTE: LCS³ No. 100 White can be used as a projection surface.

B. Writing Surface Core

1. 7/16" Medium Density Fiberboard (MDF) composed of approximately 90% post- industrial waste.

C. Writing Surface Backing

1. Aluminum Sheet Back

D. Factory Framed Markerboards and Chalkboards

1. Claridge Factory-Built Chalkboards:

a. Face Sheet: 24 Gauge Vitracite Chalkboard.
b. Core Material: 7/16" MDF.
c. Panel Backing: 0.005" Aluminum Foil Panel.
d. Series: Series 1.
e. Typical Arrangement: Type A, Type C, Type D, Type F, Type H, Type BR, reverse BL, Type ER, reverse EL, or Type GR, reverse GL – as indicated on drawings.
f. Panel Size: As indicated on drawings.
g. Panel Color: Color(s) to be selected from manufacturer's standard colors. Color charts

furnished on request.

2. Claridge Factory-Built Markerboards:

    a. Face Sheet: 24 Gauge LCS Markerboard.
    b. Core Material: 7/16" MDF.
    c. Panel Backing: 0.005" Aluminum Foil Panel.
    d. Series: Series 1.
    e. Typical Arrangement: Type A, Type C, Type D, Type F, Type H, Type BR, reverse BL, Type ER, reverse EL, or Type GR, reverse GL – as indicated on drawings.
    f. Panel Size: As indicated on drawings.
    g. Panel Color: Color(s) to be selected from manufacturer's standard colors. Color charts furnished on request.

3. Claridge Horizontal Sliding Markerboard/Chalkboard

    a. Series: Two Track
    b. Sliding panels and back panel x writing surface. 24 gauge steel LCS markerboard or 24 gauge steel Vitacite chalkboard.
    c. Core: 3/8" Honeycomb (Sliders) 3/8" particle board (back panel).
    d. Backing: Steel (Sliders) moisture barrier back (back panel).
    e. Sizes: As indicated on drawings.
    f. Typical arrangement: Two (2) sliding panels and back panel to match sliding writing surfaces.
    g. Fabrication: Reinforced corners with angles to strengthen frame. Nylon ball bearing rollers at top of unit and nylon guide rollers at bottom of unit to be of sufficient size and number to eliminate vibration and provide smooth and quiet operation of the panels.

4. Claridge Modular Markerboard, Chalkboard and Tackboard Units (Where noted on drawings):

    a. Typical Arrangement: MOD3.
    b. Writing Surface: 24 gauge Vitracite chalkboard and/or 24 gauge LCS markerboard.
    c. Tackboard Surface: Fabricork.
    d. Panel Size: As indicated on drawings.
    e. Wall Standards: Single or double aluminum wall standards, slotted to receive special modular panel clips. Standards to be fastened directly to wall on 4 foot centers.
    f. Panel Color: Color(s) to be selected from manufacturer's standard colors.

2.03 MATERIALS FOR TACKBOARDS

A. Claridge Cork: Composed of 1/4" thick self-healing, burlap backed cork laminated to a ¼" hardboard backing.

B. Factory Framed Tackboards

1. Claridge Factory Built Tackboards:

    a. Tackboard Surface: Designer Fabric: Fabric on cork underlay with 1/4" hardboard back.
    b. Series: Series 1.
    c. Typical Arrangement: Type CO, Type C, Type D, Type F, Type H, Type BR, reverse BL, Type ER, reverse EL, or Type GR, reverse GL – as indicated on drawings.
    d. Panel Size: As indicated on drawings.
    e. Panel Color: Color(s) to be selected from manufacturer's standard colors. Color charts furnished on request.

C. Claridge Tackwalls:

1. Edgewrapped panels of fabric butted together or arranged in configurations as shown on drawings.

a. Designer Fabric (3104EW), fabric on duracore backing with edges wrapped.
b. Architect shall select from fabric manufacturer's (Guilford of Maine) product line.

2.04 ALUMINUM TRIM

B. Trim shall be 6063 alloy grade aluminum with T5 tempering in accordance with ASTM B221, and shall have 201-R1 satin anodize finish.

1. Factory-Built Trim:

a. Series: Series 1.

2. Field-Assembled Trim:

a. Snap-On Aluminum Trim.
b. Length: As required by size indicated on drawings.
c. Finish: Satin Anodize.

C. Accessories:

1. Marker Tray/Chalktrough:

a. Standard continuous, hollow, box-type aluminum tray with injection molded end closures at bottom of each markerboard or chalkboard.

2. Map Rail:

a. Standard continuous 1" map rail with cork insert and end stops at the top of each chalkboard or markerboard.

3. Accessories:

a. Map Hooks: One map hook furnished for every two feet of Map Rail on Factory-Built Units.
b. Roller Brackets: (2) two each.
c. Flag Holders: (1) one each.

PART 3 - EXECUTION

3.01 PREPARATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of the work. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

B. Verify before installation that interior moisture and temperature approximate normal occupied conditions and HVAC is in place and working.

C. Verify that wall surfaces are true and plumb and are prepared and ready to receive boards.

3.02 INSTALLATION

A. Delivery factory-built chalkboard and tackboard units completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide two or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Follow manufacturer's instructions for storage and handling of units before installation.

C. Install units in locations and mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.

   1. Anchor all components securely using tamper-proof fasteners, where accessible or with completely concealed continuous hangers.

D. Coordinate job-site assembled units with grounds, trim, and accessories. Joint all parts with a neat, precision fit.

E. Do not install boards on damp walls or in damp and humid weather without heat in the building.

3.03 ADJUST AND CLEAN

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units in accordance with the manufacturer's instructions. Break in chalkboards and marker boards only as recommended by the manufacturer.

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 101400 – SIGNAGE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install non-illuminated signs at selected locations as specified herein.

1.02 GENERAL REQUIREMENTS

A. Visit the site and check field conditions, locations, and dimensions affecting this work. Report any conditions, which will interfere with, or prevent, proper execution of the work.

1.03 REFERENCES

A. 2017 - ICC 117.1 – Accessible and Usable Buildings and Facilities.

B. ASTM International (ASTM):

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories (UL):

1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. General: Comply with requirements of Section 013300 – Submittal Procedures.

B. Shop Drawings: Provide shop drawings for each type of signage required. Furnish itemized accessory lists, indicating location, height, quantity, and accessories being provided. Detail drawings showing sizes, lettering and graphics, construction details of each type of sign and mounting details with appropriate fasteners for specific project substrates.

C. Message List: Signage report indicating signage location, text, and sign type.

D. Manufacturer's Installation Instructions: Printed installation instructions for each signage system.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and available pictograms, characters, and Braille indications.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and typical pictograms, characters, and Braille indications.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years documented experience in work of this Section.

B. Installer Qualifications: Minimum five years documented experience in work of this Section.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application

workmanship.

1. Furnish signs designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging.

B. Inspect materials at delivery to verify there are no defects or damage.

C. Store products in manufacturer's original packaging until ready for installation in climate controlled location away from direct sunlight.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Install products in an interior climate controlled environment.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Signs shall be as manufactured by Allstate Sign and Plaque, 70 Burt Drive, Deer Park, New York 11729, or Architect approved equal. (Signage shall comply with M.U.T.C.D.)

2.02 SIGNAGE - GENERAL

A. It is the intent of these specifications to establish a sign standard for the Owner including but not limited to, wall-mounted directional signs, primary room identification, restrooms, assembly spaces and all code compliant Braille signage.

B. General interior signage requirements: All signs shall be as follows:

1. The vertical space allowed for a pictogram shall be a minimum of 6" in height, (i.e., picture a 6" high window with a pictogram superimposed into it; the pictogram itself does not have to be a full 6"). Within this 6" window, you cannot place Grade 2 Braille or text. Provide 1/8" thick raised white international symbol of access (where required) and raised letters and/or numerals 1/32" high (minimum), upper case Sans Serif, accompanied with Grade 2 Braille characters at least 5/8" high, but no higher than 2".

2. Raised borders around pictograms are not required and can sometimes cause confusion for the tactile reader. If used, it is suggested that they be placed a reasonable distance from the other text elements.

3. Pictograms do not need to be raised. This gives the sign maker the option to use surface engraving, reverse engraving, raised, or other methods for the pictogram portion of the sign.

Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram.

4. Pictographs and Braille shall comply with ICC A117.1-2017 and NYS Building Standards and Codes, 2016 Uniform Code Supplement. Chapter 3, Amendments to the 2020 IBC, 2020 IBC Section 202 (Definitions). International Symbol of Accessibility.

5. ADA Pictograms shall be the current standard symbol for accessibility for New York State adopted per Law A.8193/S.6846.

2.03 INTERIOR SIGNAGE

A. Provide the following Signs at locations shown on the drawings:

1. Signage color and style shall be as selected by Architect from manufacturer's full line of colors unless otherwise indicated.

B. Furnish and install, at all handicap accessible entries, signage that reads "Accessible". Allstate sign model #: X-5689. Signage color shall be "Blue".

C. Furnish and install, at locations at the site (where shown on drawings, pole mounted, die embossed 12" x 18" heavy duty steel signs, protected with three (3) coats of baked enamel. Sign shall be provided with the international words "ENTRANCE" with a directional arrow. Allstate model #: "X-7081 or X-7080" – Color: Blue. Signs shall be securely mounted on heavy rail steel (weight 2 lbs./ft.) U-channel posts, driven into the ground a minimum of four (4) feet or embedded into minimum 1'-0" diameter x 2'-0" deep concrete footings.

D. Furnish and install all building "Maximum Occupancy" signage, (18"h x 24"w) in all areas affected by the scope of work where not already provided. (Maximum Occupancy Signage shall be provided at all cafeterias, cafetoriums, gymnasiums, auditoriums and any large group assembly spaces where the floor area exceeds 1,000 sf. Contractor shall confirm all locations, style, and quantity with the Architect.) All signage shall be in conformance with local Fire Marshal's Office requirements. (Note – where shown on drawings).

E. Furnish and install "Emergency Evacuation Route" signage at all areas affected by the scope of work, (12"h x 18"w), location, style and quantity shall be as directed by Architect. Refer to Section 2.02 for lettering and Braille requirements.

F. Furnish and install at all corridor doors, door number and/or name signage. 'Allstate' sign model #: E-BTCUST. Signage shall be as selected by Architect from manufacturer's full line of colors.

G. Furnish and install girl's and boy's multi-use handicapped accessible toilet rooms, "Allstate" sign model #'s: X-7107 and X-7108.

H. Furnish and install girl's and boy's multi-use non-handicapped accessible toilet rooms, "Allstate" sign model #'s: X-7096 and X-7095.

I. Furnish and install women's and men's multi-use handicapped accessible toilet rooms, "Allstate" sign model #'s: X-5688 and X-5671.

J. Furnish and install women's and men's multi-use non-handicapped accessible toilet rooms, "Allstate" sign model #'s: X-5687 and X-5672.

K. Furnish and install Faculty Single occupancy handicapped accessible toilet rooms, "Allstate" sign model #'s: X-5688, X-5671, or X-7059. Add on signage shall be included as follows: E-FA26 or E-ST26, as selected by Architect.

L. Furnish and install Faculty Single occupancy non-handicapped accessible toilet rooms, “Allstate” sign model #’s: X-5687, X-5672, or X-5673. Add on signage shall be included as follows: E-FA26 or E-ST26, as selected by Architect.

M. Furnish and install at Girl’s Single occupancy handicapped accessible toilet rooms, “Allstate” sign model #’s: X-7107.

N. Furnish and install at Boy’s Single occupancy handicapped accessible toilet rooms, “Allstate” sign model #’s: X-7108.

O. Furnish and install at Gender Neutral Single occupancy non-handicapped accessible toilet rooms, “Allstate” sign model #: X-8003.

P. Furnish and install at Gender Neutral Single occupancy handicapped accessible toilet rooms, “Allstate” sign model #: X-8004.

Q. Furnish and install at Locker Rooms on Designated Lockers, “Allstate” Sign Model #: X-5689. Sign Color shall be ‘Blue’.

2.04 CHARACTER PROPORTION

A. Letters and numbers in signs shall have a width-to-height ratio between 3:5 and 1:1.

B. Stroke width-to-height ratio shall be between 1:5 and 1:10.

2.05 SIGN FINISH AND CONTRAST

A. Characters and background of signs shall be eggshell, matte, or other non-glare finish.

B. Characters and symbols contrast with their background - either light characters on a dark background or dark characters on a light background. Examples of acceptable color combinations would be white/black, white/red, and white blue. Unacceptable would be light green/dark green, dark green, and dark gray/black.

C. The preference is through the use of light characters or symbols on a dark background.

D. All interior plastic signage shall have a surface burning characteristic, Class A and flame spread rating not to exceed 0-25 and smoke developed rating not to exceed 450, in accordance with ASTM E-84.

2.06 ACCESSORIES

A. Double Stick Tape: 3M VHB tape or equal, with adhesive both sides.

B. Fasteners: Expansion anchors for mounting signs to existing or new masonry walls or sheet metal screws for fastening to aluminum framed walls; screw head color to match sign color.

1. Verify mounting locations with Architect and provide suitable fasteners for each substrate condition.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements

for installation tolerances and other conditions affecting performance of the work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 MOUNTING LOCATION AND HEIGHT

A. Mounting locations for braille signage shall be as follows:

1. Where a sign containing raised characters and braille is provided for rooms and spaces, signs shall be installed on the wall adjacent to the latch side of the door.

2. Where a sign containing raised characters and braille is provided at double doors with one active leaf, the sign shall be located on the inactive leaf.

3. Where a sign containing raised characters and braille is provided at double doors with two active leaves, the sign shall be located to the right of the right-hand door.

4. Where there is no wall space to the latch side of a single door, or to the right side of double doors, signs shall be placed on the nearest adjacent wall.

5. Signs containing raised characters and braille shall be located so that a clear floor area 18” minimum by 18” minimum, centered on the raised characters is provided beyond the arc of any door swing between the closed position and 45 degree open position.

B. Mounting height shall be 48” minimum above the floor, measured to the baseline of the lowest raised character and 60" maximum above the floor, measured to the baseline of the highest character of the sign.

C. Mounting location for such signage shall be so that a person may approach within 3" of signage without encountering protruding objects or standing within the swing of a door.

D. Location and colors of signs shall be as selected by the Owner and approved by the Architect. Contractor shall submit shop drawing indicating room name/location and wording along with color samples and manufacturer’s literature for review and approval.

E. Signs shall be securely mounted to the wall surface as recommended by the manufacturer and as approved by the Architect.

F. All signage shall be installed in accordance with ICC A117.1-2017 and ADA standards and requirements.

3.03 GUARANTEE

A. All materials and workmanship shall be guaranteed for a period of not less than one (1) year from date of final completion in accordance with the applicable provisions of the "General Conditions".

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 101416 – ROOF IDENTIFICATION PLAQUE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to the work of this section.

1.02 DESCRIPTION OF WORK

A. Work shall include, but is not limited to, the following:

1. Furnish and install new roof project identification plaque.

1.03 SUBMITTALS

A. Submission shall be in accordance with Section 013300 – Submittal Procedures.

B. Samples: Submit a full-size constructed sample of the laminated sign to illustrate materials and workmanship. Acceptable unit may be installed as part of the work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Two (2) 1/8-inch thick clear, non-glare plexiglass acrylic sheets - 8 1/2-inch x 11 inch with 1/2-inch radius rounded corners. Provide 3/16-inch diameter holes in each corner for mounting screws.

B. Copy: Include sheet at end of this section with printed information provided by Contractor.

C. Accessories: Finish washers and screws appropriate for substrate.

2.02 FABRICATION

A. Position copy between the two (2) 1/8-inch thick clear, non-glare plexiglass acrylic sheets.

PART 3 - SECTION

3.01 INSTALLATION

A. Install sign units and components at locations as directed by Architect securely mounted to substrate with appropriate fasteners.

B. Install level, plumb, and at proper height, with sign surfaces free from defects in appearance.

3.02 CLEANING AND PROTECTION

A. At completion of the installation, clean soiled sign surfaces.

END OF SECTION

ROOF PROJECT IDENTIFICATION PLAQUE

[DATE OF INSTALLATION]

MANUFACTURER
[NAME]
[ADDRESS]
[PHONE NUMBER]

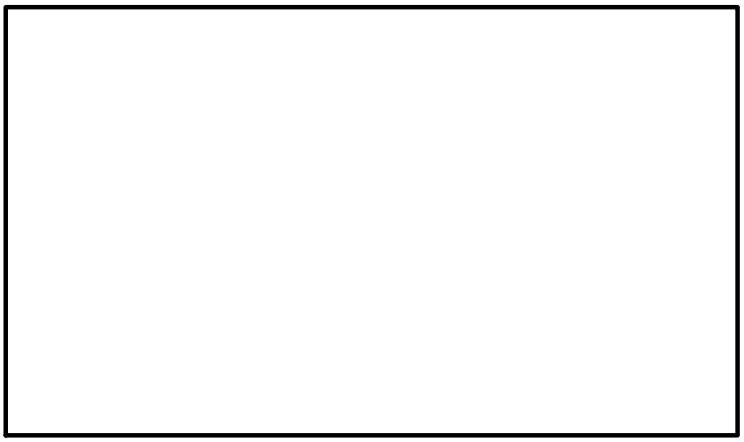
CONTRACTOR
[NAME]
[ADDRESS]
[PHONE NUMBER]
[E-MAIL ADDRESS]

MANUFACTURER'S WARRANTY PERIOD
[DATE]

CONTRACTOR'S GUARANTEE PERIOD
[DATE]

[METHOD OF REPAIR]

[REPAIR KIT MODEL NUMBER]



KEY PLAN

CONTRACT AREAS

DIVISION 10 - SPECIALTIES

SECTION 101453 –TRAFFIC SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Under this item, the Contractor shall furnish and install signs at locations indicated in the Contract Documents or directed by the Architect including all required operations specified.

B. This work shall consist of fabricating, installing and covering grounds traffic and parking sign panels, sign support systems, and sign posts in accordance with the Contract Documents, standard sheets, the Manual on Uniform Traffic Control Devices (MUTCD) and as directed by the Engineer.

C. These specifications are intended to meet the 2008 N.Y.S D.O.T. standards specifications in U.S. Edition Section 403. It can be found at: www.nysdot.gov/main/businesscenter/engineering/specificationsupdated-standard-specifications-us.

D. GC shall be responsible for all N.Y.S D.O.T. specification sections referred to herein or referred to within related specification sections found on the N.Y.S D.O.T. website.

E. The work must comply with the requirements of the following related specifications sections when applicable:

1. Section 033000 – Cast-In-Place Concrete
2. Section 310000 – Earthwork
3. Section 310001 – Site Work General Provisions
4. Section 321216 – Asphalt Paving
5. Section 329200 – Turf and Grasses

1.02 SUBMISSIONS

A. In accordance with Section 013300 the Contractor shall provide shop drawings and product data. Contractor shall furnish and be responsible for all dimensions not given, such as post lengths, which are required in conjunction with layout for construction.

B. Submit manufacturer's product data.

C. Samples

D. Shop Drawings

PART 2 – MATERIALS

2.01 GENERAL

A. Materials shall meet the requirements of the following subsections of N.Y.S D.O.T. *Section 700 Materials and Manufacturing*:

1.	Stainless Steel Connecting Products	715-16
2.	Aluminum Sign Panels	730-01
3.	Reflective Sheeting	730-05
4.	Reflectorized Sheeting Sign Characters (Type IV)	730-12

5. Reflectorized Sheeting Sign Characters (Type V) 730-13
6. Stiffeners, Overhead Brackets, and Misc. Hardware 730-22
7. Type A Sign Supports 730-24
8. U-Bolts ASTM F1554, Grade 36

2.02 SIGN PANELS

A. Fabrication of all components shall produce a finished sign panel. Holes may be punched or drilled. Edges shall be smooth and true and free from burrs or ragged breaks. Sign panels shall be fabricated as shown on the standard sheets. Details for signs that are not shown on the standard sheets shall be similar to the closets shown sign blank size. All sign panels shall be clearly marked in the lower right corner on the back of the sign panel to show the Contract Number and the installation date (month/year). Markings shall be a minimum of 1 inch high and shall be permanently engraved, labels attached with pressure-sensitive adhesives, marked with an indelible ink or paint, or established by another method approved by the Engineer. U-Bolts used to attach sign panels to overhead sign structures shall be Type II galvanized in accordance with N.Y.S D.O.T. §719-01 Galvanized Coatings and Repair Methods.

B. Ground-Mounted Sign Panels

1. Ground-Mounted Sign Panels without Z-bars

a. Ground-Mounted signs without Z-bars shall be 10-gauge thick meeting the requirements of N.Y.S D.O.T. §730-23 *Fiberglass Reinforced Plastic Sign Panels* for sign panels up to 4 feet x 4 feet.

2. Ground-Mounted Sign Panels less than or equal to 30 square feet (with Z-bars)

a. Ground-mounted signs with Z-bars less than or equal to 30 square feet shall be 10-gauge thick meeting the requirements of N.Y.S D.O.T. §730-01 Aluminum Sign Panels or 0.132 inch thick, meeting the requirements of N.Y.S D.O.T. §730-23 Fiberglass Reinforced Plastic Sign Panels for sign panels up to 4 feet x 4 feet.

3. Ground-Mounted Sign Panels greater than 30 square feet (with Z-bars)

a. Sign panels for Ground-Mounted Sign Panels greater than 30 square feet shall be 8-gauge thick meeting the requirements of N.Y.S D.O.T. §730-01 *Aluminum Sign Panels*.

C. Sign Panels with Multiple Sheeting types

1. The panel thickness for sign panels with multiple types of sheeting types shall be determined using the total area of the sign panel and meet the materials requirement above.

D. Reflective Sheeting

1. Reflective sheeting materials used on sign panels shall conform to the requirements of N.Y.S D.O.T. §730-05 *Reflective Sheeting*. Type I (Class A) sheeting may be used on tourist and motorist services signs. Type III (Class B) sheeting shall be used on regulatory, warning, route marker, and guidance signs unless specified otherwise below.

2. Type I (Class A) sheeting shall be used whenever brown reflective sheeting is specified and may be processed by a sign fabricator in its shop. The legend for a sign with brown background shall be made by applying cut-out letters or symbols of Type I (Class A) yellow sheeting.

a. High-Visibility Sheeting

1) Signs with the following MUTCD codes shall be fabricated using Type IX (Class E) sheeting: R1-1, R1-2, R1-4, R1-5, R3-1, R3-2, R3-4, R3-18, R5-1 and R5-1a.

b. High-Visibility Fluorescent Yellow Sheeting

1) Sign with the following MUTCD codes shall be fabricated using Type IX (Class E) fluorescent yellow sheeting for the yellow portion of the sign face, and the appropriate non-fluorescent Type IX (Class E) color for the remainder of the sign face: E11-1, E11-1a, E11-1b, E11-1c, W1-7 and W1-8.

c. High-Visibility Fluorescent Yellow-Green Sheeting

1) Signs with the following MUTCD codes shall also be fabricated suing Type IX (Class E) fluorescent yellow-green sheeting for the yellow portion of the sign face, and the appropriate non-fluorescent Type IX (Class E) color for the remainder of the sign face: NYR2-7, NYR2-8, S1-1, S3-1, S4-3, S4-5, W11-1, W11-1, W11-9, W15-1, W16-1 and 16-7p. In addition, signs with the following MUTCD codes mounted on the same support system shall also be fabricated using Type IX (Class E) fluorescent yellow-green sheeting for the yellow portion of the sign face, and the appropriate non-fluorescent Type IX (Class E) color for the remainder of the sign face: W16-2, W16-2a, W16-3, W16-3a, W16-4 and W16-9p.

E. Sheeting Sign Characters

1. Characters include letters, numerals, route shields, symbols and borders. Characters shall be the size, series and color specified in the MUTCD and as specified in the Contract Documents Only Type IV or Type V Characters, as appropriate, shall be used. White legends and borders shall be formed with directly-applied Type IV Characters. Interstate shields for signs shall be either demountable panels or directly-applied panels with Type V reverse-screened characters. Sign face characters and background shall be reflective, but black portions of a sign face shall not be reflective.

F. Sign Face Layouts

1. Sign face shape, color, dimensions, and characters shall be in accordance with:

a. Manual of Uniform Traffic Control Devices for streets and highways (FHWA).

b. New York State Supplement to the National Manual on Uniform Traffic Control Devices for Streets and Highways.

c. Standard Highway Signs Book – (FHWA)

After Contract award, two copies of non-standard sign face layouts will be provided to the Contractor. The Contractor shall verify dimensions on the sign face layouts prior to fabrication. (Standard sign face layouts for MUTCD codes without the prefix NY are shown in the Standard Highway Signs Book written by the Federal Highway Administration).

2.03 TYPE A SIGN POSTS

A. Sign posts shall be galvanized steel U-channel of not less than 3.0 lbs./ft. and shall meet the New York State Department of Transportation requirements for structural steel and ASTM Specification B308 and 6061-T6. The standard strength (i.e., moment capacity) of a Type A sign post shall be 2100 ft-lbs, although weaker or stronger posts may be substituted when permitted.

1. Type A Sign Posts with Extra Embedment, as indicated on drawings.

a. Type A sign posts with extra embedment (more than 3 feet) shall meet the requirements of the NYS DOT Materials Details for Type A sign supports.

2. Soil Plates for Type A Sign Posts, as indicated on drawings.

   a. Type A sign posts with soil plates shall meet the requirements of the Materials Details for Type A Sign Supports.

3. High-Capacity Type A Sign Posts, as indicated on drawings.

   a. High-Capacity Type A sign post are defined as any Type A sign post system shown in the NYS DOT Materials Details for Type A Sign Supports that has a total combined capacity for the entire two- or three-post system higher than 7800 ft-lbs. The Contractor shall calculate the design moment of the sign panel, and select an appropriate High-Capacity Type A sign post system capable of resisting that moment, subject to the Engineer's/ Architect's approval.

PART 3 – EXECUTION

3.01 PROCEDURE

A. Signs shall be located 7 feet above grade (to bottom of sign) at locations shown on the plans except where indicated otherwise.

B. All signs shall be erected truly vertical.

3.02 GENERAL

A. Sign panels, overhead panels, overhead vertical brackets, vertical and horizontal Z-bars, sign support systems, signposts, breakaway bases and hinge assemblies, shall be constructed in accordance with the Contract Documents, NYSDOT standard sheets, MUTCD and material details. Sign locations shown in the Contract Documents are approximate, and the exact location for each sign will be approved by the Architect/Engineer.

B. The Contractor shall erect new signs and remove existing signs in such a manner that the traveling public is provided all necessary regulatory, warning, and guidance information at all times. Certain items may be designed to be performed prior to other work items.

C. An inspection of installed signs will be made in the daylight for color, reflectivity, location, vertical post alignment, visibility and appearance. The installed signs may also be inspected at night for color, orientation and reflectivity, traits which will be more than conspicuous at night.

D. Wind Loads

1. The wind pressures given on the standard sheets have been calculated according to the procedure in the *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and traffic Signals (latest edition)*. All wind loading shall be adjusted for height, drag, and gusting in accordance with *AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaries, and traffic Signals (latest edition)*. Allowable sign areas shall be reduced when the sign centroid height is at an elevated site condition (e.g., an overpass) where the influence of the ground on the wind is reduced. For example, a sign centroid between 29 feet and 49 feet above the existing ground would result in a 37.5% increase in wind pressure (refer to section "Loads" in aforementioned AASHTO Specifications).

TABLE 645-1 WIND LOAD CRITERIA				
	Region	**Wind Velocity (mph)**	**Wind Pressure at Panel ≤ ~~140~~ 14.0 ft (psf)**	**Wind Pressure at Panel ≥ ~~140~~ 14.0 ft (psf)**
Type A Post	1, 2, 6, 8, and 9	60	14.4	19.2
	3, 4, 5, 7, 10 and 11	70	20.4	25.2

NOTE: Panel centroid height measured above the surrounding terrain.

3.03 SIGN PANELS

A. Sign panels shall be installed as shown on the standard sheets or as shown in the Contract Documents. Layout of sign panels and assemblies shall be as shown in the Contract Documents.

3.04 TYPE A SIGN POSTS

A. The Contractor shall install Type A sign posts individually or in groups to provide the requirement moment resistance. Type A sign posts with Extra Embedment, and Soil Plates for Type A sign post shall be installed where extra embedment depth and/or soil plates are required. High Capacity Type A sign posts shall also be installed where extra moment capacity is required.

B. The number of Type A sign posts indicated in the Contract Documents is based on the information available during design. The number and strength of Type A sign posts installed shall be based on conditions at the final sign location approved by the Engineer. The Contractor shall determine the required moment resistance for the Type A sign post(s) due to the wind loads indicated in N.Y.S D.O.T. §645-3.01A.

C. Wind Loads, and propose an appropriate number and strength of Type A sign posts for the approval of the Engineer. The Contractor shall submit approved Materials Details, and any computations, to the Engineer, and install the required number of Type A sign posts subject to the following criteria:

1. For signs with a nominal width greater than 30 inches, at least two posts are required, except that the nominal 30 inch x 30 inch diamond panel and the nominal 36 inch wide “YIELD” panel require only one post.

2. The maximum number of posts installed within a 7 foot path shall be as described on the approved materials list.

3. For single flanged channel post installations only, the required moment resistance for the post shall be increased by 25% to account for torsional shear. The materials details include this adjustment.

3.05 CONCRETE FOUNDATIONS

A. Concrete foundations shall be constructed in accordance with the details shown on the drawings and in accordance with Division 03 Concrete Specifications. Upon completion of the sign installation the Contractor shall restore the area to its original state.

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 102119 – PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to the work of this section.

B. Provide all labor, materials, etc. necessary for the completion of the work of this section as specified or shown on the drawings.

C. Work of this section consists of, but is not limited to, the following:

1. Provision and installation of solid polymer toilet stalls, stall doors, urinal screens, privacy screens, restroom entry partitions and shower partitions.

2. Hardware, etc. for stalls & partitions.

1.02 RELATED SECTIONS

A. Section 061000 – Rough Carpentry
B. Section 055000 – Metal Fabrications
C. Section 102813 – Toilet Accessories

1.03 REFERENCES

A. ASTM International:

1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
2. ASTM D 1735 - Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
3. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity

B. NFPA – National Fire Protection Association:

1. NFPA 286 – Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

C. United States Green Building Council (USGBC): LEED Green Building Rating System

1.04 SUBMITTALS

A. All submittals shall be in accordance with Section 013300 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Literature indicating typical panel, pilaster, door, hardware and fastening.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings:

1. Dimensioned plans indicating layout of toilet compartments.
2. Dimensioned elevations indicating heights of doors, pilasters, separation partitions, and other components; indicate locations and sizes of openings in compartment separation partitions for toilet and bath accessories to be installed in partitions; indicate floor and ceiling clearances.
3. Details indicating anchoring components (bolt layouts) and methods for project conditions; indicate components required for installation, but not supplied by toilet compartment manufacturer.
4. Details showing locations for adequate steel reinforcements of wood blocking in walls to be provided for proper securement of the finished work.

D. Selection Samples: For each finish product specified, one complete set of color selection guides representing manufacturer's full range of available colors, textures and patterns.

E. Verification Samples: For each finish product specified, two samples representing actual product, color, texture and pattern.

F. LEED Green Building Rating System: Submit manufacturer's documentation of recycled content, in accordance with LEED credit calculations.

G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.

C. Lay cartons flat, with adequate support to ensure flatness and to prevent damage to pre- finished surfaces.

D. Do not store where ambient temperature exceeds 120 degrees F (49 degrees C).

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at a minimum of 60 degrees F (15.6 degrees C).

1.07 WARRANTY

A. Manufacturers Standard Warranty: Provide warranty for Solid polymer HDPE Material: Against breakage, corrosion, and delamination for 25 years.

1.08 COORDINATION

A. Coordinate Work with placement of support framing and anchors in walls and ceilings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: ASI Global Partitions, which is located at: 900 Clary Connector; Eastanollee, GA 30538; Tel: 706-827-2700; Fax: 706-827-2710; Email: request info (sales@asi-globalpartitions.com); Web: http://asi-globalpartitions.com

2.02 COMPARTMENTS AND SCREENS

A. Toilet Compartments: Floor anchored/overhead braced solid polymer.

1. Compartment Depth and Width: As scheduled and indicated on Drawings.
2. Door Width: 24 inches (610 mm), minimum; at ADA accessible compartments 36 inches (915 mm) minimum.
3. Height Above Floor: 14 inches (356 mm).
4. Door/Panel Height: 55 inches (1397 mm).
5. Pilaster Height: 82 inches (2083 mm).

B. Privacy and Urinal Screens: Wall hung:

1. Screen Panel Size: 24 inches (610 mm) wide by 48 inches (1219 mm) high.

2.03 SOLID POLYMER TOILET COMPARTMENTS

A. Doors, Panels, Screens, and Pilasters: Single sheet solid, homogenous HDPE plastic material formed from waterproof, non-absorbent, high-density polyethylene resins; mark- resistant self-lubricating surface; edges finished smooth.

1. Material: Solid, homogenous HDPE; 1 inch (25 mm) thick.
2. Rating: Class "B" Fire Rated per ASTM E 84.
3. Material shall be compliant with IBC 2012 or later and must be solid HDPE; foamed material is not allowed. Material shall be NFPA 286 compliant.
4. Edges: 1/4 inch (6 mm) radius machined edges.
5. Heat Sink: Aluminum heat sink, to dissipate heat from incendiary devices used by vandals, attached to bottom of doors and panels.

B. Finish: Pebble-textured homogenous color throughout material. Color as selected by Architect from manufacturer's standard colors. 18 colors available in NFPA286. (Hammered finish available in NFPA286 in metallic silver and bronze color only).

C. Door Hardware: 8 inch X 1/8'' thickness aluminum wrap-around hinge

1. Hinges: Hinges shall be 8 inches x 1/8" thickness and fabricated from heavy-duty 1/8" extruded aluminum (6463-T5 alloy) with a brushed anodized finish with wrap-around flanges, surface mounted and through bolted to doors and pilasters. Hinges operate and are field set with adjustable nylon cams. Cams can be set in 30 degree increments.
2. Latch: Anodized extruded aluminum, with housing, slide bolt and button.
3. Strike and Keeper: 6 inch (152 mm) wrap-around flanges fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with a brushed anodized finish.
4. Coat Hook and Bumper: Non-ferrous, chrome-plated, with black rubber tip for doorstop.
5. Fastening Hardware: Manufacturer's standard, Type 304 stainless steel, No. 4 satin finish, theft-resistant barrel nuts and machine screws.
6. Door Pulls: Non-ferrous, chrome-plated. Standard on ADA compartments. Two per ADA door.

D. Mounting Brackets: Provide aluminum continuous U brackets fabricated from heavy-duty 1/8'' thick extruded aluminum (6463-T5 alloy) with a brushed anodized finish, theft resistant barrel nuts and shoulder screws. Each bracket shall have 4 pre-drilled holes spaced evenly across a 53-1/2'' long continuous bracket starting at ¾'' from either end of bracket.

E. Pilaster Shoes: Type 304 Stainless Steel No. 4 satin finish, 20 gauge. Easy Stall shoe shall be of a one piece design and integral to the mounting system and formed from 304 stainless steel 3 inch (76 mm) high with a No. 4 satin finish. Pilaster shoes are anchored to the pilaster with No. 10 stainless steel, vandal-resistant screws.

F. Headrail: Manufacture's standard anodized aluminum rail with anti-grip profile.

G. Pilaster Anchors: Floor Anchored/Overhead Braced.

1. Easy Stall shoe system. 1/4 by 2 inch (6 by 51 mm) steel screws attach Easy Stall shoe to floor.
2. Pilaster to be inserted into shoe and secured after height adjusted. Leveling adjustment to be concealed by pilaster shoe.
3. Height/leveling adjustment to be made via machine thread bolts inserted into factor installed threaded insert in bottom of pilaster.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions. Clean surfaces thoroughly prior to installation.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

1. Verify dimensions of areas to receive compartments.

2. Verify locations of built-in framing, anchorage, bracing, and plumbing fixtures.

3.02 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's instructions.

B. Fasten components to adjacent materials and to other components using purpose-designed fastening devices.

C. Adjust pilaster anchors for substrate variations; conceal anchors with pilaster shoes.

D. Equip each compartment door with hinges and door latch.

E. Install door strike keeper on pilasters in alignment with door latch.

F. Equip each compartment door with one coat hook and bumper.

G. Installation Tolerances:

1. Maximum variations from plumb or level: 1/8 inch (3 mm).

2. Clearance between wall surface and panels or pilasters: 1-1/2 inch (38 mm) maximum.

3.03 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors.

B. Adjust adjacent components for consistency of line or plane.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Remove factory protective coverings and clean finish surfaces in accordance with manufacturer's instructions before substantial completion.

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 102813 – TOILET ACCESSORIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Cabinet-type toilet accessories.

1. Roval Collection.
2. Profile Collection.
3. Traditional Collection.

B. Toilet accessories.

1. Grab bars.
2. Electric hand dryers.
3. Mirrors.
4. Paper Towel Dispensers
5. Soap Dispensers
6. Toilet Tissue Dispensers
7. Feminine hygiene vendors and disposals
8. Baby changing stations.

1.02 RELATED SECTIONS

A. Section 061000 – Rough Carpentry
B. Section 092900 – Gypsum Wall Board
C. Section 093013 – Ceramic Tile
D. Section 102113 – Metal Toilet Compartments
E. Section 102114 – Stainless-Steel Toilet Compartments
F. Section 102119 – Plastic Toilet Compartments

1.03 REFERENCES

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
E. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Service 2015a (Reapproved 2019).
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
H. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2018, with Editorial Revision (2021).
I. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.
J. ASTM C1036 - Standard Specification for Flat Glass 2021.
K. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

L. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
M. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).
N. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Shop Drawings:

1. Plans: Locate each specified unit in project.
2. Elevations: Indicate mounting height of each product.
3. Details: Indicate anchoring and fastening details, required locations and types of anchors and reinforcement, and materials required for installation of specified products.

D. Verification Samples: Two sample chips of each specified color and finish.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

F. Quality Assurance Submittals:

1. Printed installation instructions for each specified product.
2. Documentation of Manufacturer's Qualifications, specified in 1.06 of this Section.

G. Closeout Submittals: Warranty, issued and executed by manufacturer, and countersigned by Contractor.

H. All accessories to be type 304 stainless steel and be shown on technical data sheets as such.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years documented experience producing products specified.

B. Source Limitations: To the greatest extent possible products shall be provided by a single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ship products in manufacturer's standard protective packaging with vinyl coating on exposed surfaces.

B. Storage and Protection: Store products in manufacturer's protective packaging until installation.

1.08 WARRANTY

A. Manufacturer's standard warranty against defects in product workmanship and materials.

B. Manufacturer's 15-year warranty against silver spoilage of mirrors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: American Specialties, Inc.; 441 Saw Mill River Road, Yonkers NY 10701-4913. ASD. Tel: (914) 476-9000. Fax: (914) 476-0688. Email: infoatamericanspecialties.com. Web: http://www.americanspecialties.com

B. Basis-of-Design Product: Subject to compliance with requirements, provide the electric Dyson Airblade V hand dryers manufactured by Dyson Inc., 1330 W. Fulton St., Floor 5, Chicago, IL 60607; 888-397-6622 www.dyson.com/Airblade or comparable product acceptable to the Architect.

C. Requests for equivalency will be considered in accordance with provisions of Section 013300.

2.02 CABINET-TYPE TOILET ACCESSORIES (ROVAL COLLECTION)

A. Basic Construction Requirements:

1. Doors: Curved design, one piece Type 304, 18 gauge, 0.05 inch (1.27 mm) stainless steel.

2. Cabinets: Type 304, 22 gauge, 0.0312 inch (0.79 mm)stainless steel, trimless; joints welded, sight-exposed welds finished to match sheet finish. Full access back panels.

3. Hinges: Concealed, heavy-duty stainless steel multi-staked piano hinge, full length of cabinet.

4. Locks: Two flush, rimless tumbler locks, keyed alike other toilet accessory locks, with one key for each lock.

5. Exposed Finish: No.4 satin finish, unless noted otherwise.

B. Feminine Hygiene Disposals: Roval Collection by ASI.

1. Surface Mounted Sanitary Waste Receptacle: **ASI Model 20852**. Lid and cabinet are each drawn one piece construction. Lid is secured to the cabinet with a heavy-duty 9/64 in (3.6 mm) multi-staked concealed piano hinge.

C. Feminine Hygiene Vendors: Roval Collection by ASI.

1. Recessed Dual Sanitary Napkin and Tampon Dispenser: **ASI Model 04684**. Dispenses 15 napkins and 23 tampons. Door made of 18 ga type 304 satin finish stainless steel, with two flush tumbler locks. Universal coin mechanism is convertible for 25 cents, 50 cents or FREE (no coin) operation. Coin boxes have different lock and key than doors and collar for surface mounting. Provide and install **ASI Model 04684-9 Surface Mounting Adaptor Collar** with all units supplied.

D. Mirrors: Roval Collection by ASI. (All mirrors to be tempered)

1. Stainless Steel Mirror (Tempered Glass):**ASI Model 20650-B 1836**. The gently radius edges provide added strength and complement the curves of the ASI Roval Collection. Frame

fabricated of 18 ga type 304 stainless steel with satin finish and polished seamless mitered corners. 1/4 in (6.4 mm) thick tempered glass mirror.

2. Stainless Steel Mirror with Integral Shelf**: ASI Model 20655-B 1836**. The gently radius edges provide added strength and complement the curves of the ASI Roval Collection. Mirror frame and 6 in (152 mm) wide curved edge shelf are fabricated of 18 ga type 304 stainless steel with satin finish. Mirror frame has polished seamless mitered corners. 0.25 in (6.4 mm) thick tempered glass mirror.

3. Frameless Mirror: ASI Model 8287-A. Size and location as indicated on drawings. Frameless Mirror shall be fabricated of 1/4" [6.4] polished plate glass and shall comply with ASTM C 1503-01 and government specification No. DD-M-411-C and shall be warranted against silver spoilage for (15) years. Mirror shall be supplied as one piece up to 32 ft² (2.97 m²) and up to 96” x 48” [2438 x 1219] in W x H. Mirrors larger than 32 ft² (2.97 m²)or with linear W or H dim larger than 96” [2438] shall be supplied as multiple pieces.

2.03 CABINET-TYPE TOILET ACCESSORIES (PROFILE COLLECTION)

A. Basic Construction Requirements:

1. Doors: Type 304, 16 gauge, 0.0625 inch (1.59 mm) stainless steel, formed 15/16 inch (23.8 mm) return to wall, with vertical edges eased at 3/4 inch (19 mm) radius; welded corners.

2. Cabinets: Type 304, 20 gauge, 0.0375 inch (0.95 mm) stainless steel, formed 1 inch (25 mm) wide flat perimeter trim four sides; joints welded, sight-exposed welds finished to match sheet finish.

3. Hinges: Heavy-duty stainless steel multi-staked piano hinge, 3/16 inch (5 mm) diameter barrel, full length of cabinet; hinge leaves spot-welded to door and cabinet body.

4. Locks: Flat rimless tumbler locks, keyed alike other toilet accessory locks, with two keys for each lock.

5. Cabinet and Door Finish: No.4 satin finish.

B. Toilet Tissue Dispensers/Holders: Profile Collection by ASI.

1. Surface Mounted Dual Roll Toilet Tissue Dispenser: **ASI Model 9030.** 18g door, 22 gauge cabinet and flush mounted lock. Holds two rolls up to 5-1/4 in (135 mm) dia (1800 sheets). Top roll automatically drops in place when bottom roll done. Type 304 stainless cabinet and mechanism. Theft resistant spindles.

2.04 CABINET-TYPE TOILET ACCESSORIES (TRADITIONAL COLLECTION)

A. Basic Construction Requirements:

1. Doors: 22 ga stainless steel, double pan construction, with 1/4 in (6 mm) thick structural fiberboard core.

2. Cabinets: 22 ga stainless steel, formed perimeter trim with 1/4 in (6 mm) return to wall four sides; joints welded, sight-exposed welds finished to match sheet finish.

3. Hinges: Heavy-duty stainless steel multi-staked piano hinge, 3/16 inch (5 mm) diameter barrel, full length of cabinet; hinge leaves spot-welded to door and cabinet body.

4. Locks: Flat rimless tumbler locks, keyed alike other toilet accessory locks, with two keys for

each lock.

5. Cabinet and Door Finish: No.4 satin finish.

B. Paper Towel Dispensers: Traditional Collection by ASI.

1. Paper Towel Dispenser: **ASI Model 0210**. Dispenses 400 C-fold or 525 multi-fold paper towels without adjustment or adapters. Fabricated of 22 ga stainless steel with Satin finish. Fitted with tumbler lock and heavy duty stainless steel piano hinge.

2. Surface mounted Roll Paper Towel Dispenser: **ASI Model 8522.** Unit dispenses pre-set lengths per cycle from 8 in or 9 in (205 or 230 mm) wide, 800 ft (244 m) long rolls with mechanical dispenser. Three pre-set dispensing lengths.

2.05 TOILET ACCESSORIES

A. Basic Construction Requirements:

1. Doors: 22 ga satin stainless steel, formed hems at sight-exposed edges.

2. Cabinets: 22 ga satin stainless, formed hems at sight-exposed edges; joints welded.

3. Hinges: Stainless steel piano hinge, 3/16 in (4.8 mm) dia barrel, full length of cabinet; hinge leaves spot-welded to door and cabinet body.

4. Locks: Tumbler locks, keyed alike other toilet accessories, two keys for each lock.

B. Custodial Accessories: As manufactured by ASI.

1. Utility Shelf with Mop Holders and Rag Hooks: Type 304 satin stainless. Shelf is 8 in (200 mm) deep with 3/4 in (19 mm) return for rigidity. Mop holders are riveted to strip and rubber cam is ribbed for grasping. Rod and hooks for wet rags included.

a. **ASI Model 1315-4:** 4 mop holders/3 rag hooks, 36 in (915 mm) long.

C. Shower Curtain Rods: As manufactured by ASI.

1. Shower Curtain Hook: **ASI Model 1200-SHU**. Stainless steel hook for rods 1 in (25 mm) and 1-1/4 in (32 mm) dia.

2. Vinyl Shower Curtain: **ASI Model 1200-V**. Flame resistant, anti-bacterial, 8 ga vinyl fabric. Curtain shall be 6 in (150 mm) wider than opening up to 48 in (1220 mm) and 12 in (305 mm) wider than openings exceeding 48 in (1220 mm). Sizes and colors as scheduled or indicated on Drawings.

3. Extra Heavy-Duty Shower Curtain Rod: **ASI Model 1204**. Flanges 3 in (75 mm) dia, 20 ga type 304 satin stainless. 1-1/4 in (32 mm) dia rod, 18 ga type 304 satin stainless tubing. Available in lengths up to 96 in (2440 mm).

4. Folding Shower Seat (Handed): **ASI Model 8206**. Meets ADA Accessibility Guidelines and the needs of the physically disabled and elderly. Seat is 1/2 in (13 mm) thick, one piece solid phenolic, ivory colored. Frame, support legs, flanges, and bracket are type 304 satin finish stainless steel. Features a reversible self-locking mechanism. Seat measures 33 in (840 mm) wide and projects 22-7/8 in (580 mm) from wall.

D. Soap Dispensers: As manufactured by ASI.

1. Horizontal Surface Mounted Soap Dispenser: **ASI Model 9343.** All-purpose valve dispenses liquid, lotion and detergent-type soaps. It has a tamper-resistant refill window with concealed fastening and vandal-resistant hinged filler-top. Capacity: 48 fl. oz. (1.4 L).

E. Towel and Clothes Hooks: Single As Manufactured by ASI.

1. Single Robe Hook: **ASI Model 7308**. Extends 2-5/16 in from wall or door. Suitable for robes, clothing or small bags. Robe Hook shall be type 304 stainless steel alloy 18-8. Wall flange shall lock to wall bracket with stainless steel M5 hex socket set screw concealed on bottom perimeter of flange. Post shall be 22 gauge tubing with formed 18 gauge threaded bracket welded inside end. Hook shall be solid pin. Flange shall be 1/16" (1.5) thick with 3/32" (2.3) thick sides and heavy reinforcement ribs. Post shall be bolted to flange with concealed and locked M6 (Ø1/4") screw. All exposed surfaces shall have satin finish. Wall bracket shall be 18 gauge with embossed ribs for added strength and shall have two (2) mounting slots to accommodate M4 pan head screws (provided) and allow slight installation alignment adjustment. Hex L-key (M2.5) is provided to lock set screw to secure unit to wall bracket

2.06 GRAB BARS

A. Grab Bars:

1. Size: Straight grab bar, lengths as indicated on Drawings.

2. Covers: Snap over flange to conceal screws; type 304 stainless steel, 22 ga, 3-3/16 in (81 mm) dia.

3. Concealed Mounting Flanges: 3-1/8 in (79 mm) O.D. dia with two screw holes and three locking dimples; 1/8 in (3 mm) thick, type 304 stainless steel.

4. Series: 3700 Series by ASI; 1-1/4 in (32 mm) dia handrail with snap-on flange covers.

a. Product: **ASI Model 3700-P Series**, with peened surface.

2.07 ELECTRIC HAND DRYERS

A. Electric Hand Dryers: The electric Dyson Airblade V Electric hand dryer [307174-01 (sprayed nickel LV)].

1. Provide at locations and in quantities as shown on the drawings. If not shown in the drawings, only paper towel dispensers are required.

2. Mounting: Surface mounted on ABS/PBT plastic backplate/mounting bracket; protrudes four inches from wall, no recessing required; ADA compliant.

3. Construction: Polycarbonate casing with anti-microbial [additive in paint]. Anti-microbially integrated external plastics and seals. Anti-tamper M4 exterior pin-hex screws. Water ingress protection to IP24.

4. Color Finish: [Sprayed nickel] finish.

5. Filtration: 99.97 percent particulate efficiency HEPA filter with anti-microbial coating.

6. Operation: Touch-free capacitive sensor activation.

a. Hand dry time: 12 seconds

b. Airspeed at nozzle: 420 mph
c. Operating Airflow: up to 5.28 gal/sec.
d. Rated Operating Noise Power: 79 db(A)

7. Motor: Dyson Digital Motor (DDM), V4 switched reluctance brushless DC type; 92,000 rpm motor speed; less than 0.5 watt standby power consumption.

8. Electrical Requirements: [110-127 V AC, 12 A. 1000 W] Dyson recommends 15 amp circuit.

9. Operating Temperature Range: 0 – 40 degrees C.

10. Standby Power Consumption: Less than 0.5 W.

2.08 NARCOTICS CABINETS: FOR NURSES OFFICE

A. Narcotics Cabinets, **ASI Model 0547**, Stainless steel-Dual door with combination lock:

1. Surface mounted security cabinet for controlled narcotic substances shall be type 304 alloy 18-8 stainless steel of double wall all welded construction.

2. Cabinet shall be 22 gauge and doors shall be 18 gauge. All exposed surfaces shall have satin finish.

3. Doors are attached to cabinet with welded on full length 3/16" diameter [Ø4.8] piano hinges. Outer door has all returns toward inside. Inner door has top & bottom returns turned in and latch edge turned out for enhanced security. Five (5) button combination tumbler locked latches with dead bolts shall hold both doors closed.

4. Two (2) stainless steel 22 gauge satin finish shelves with hemmed edges shall be furnished and spacing shall be easily adjusted by owner using eight (8) track clips provided.

5. Top cover is removable when inner door is opened and may be reattached to bottom when unit is inverted to reverse hand of door swing in the field. Lock programming instructions are provided.

2.09 DIAPER CHANGING STATION

A. Horizontal Recessed Mounted Stainless Steel Baby Changing Station shall be **ASI Model No 9018-9** as manufactured by *American Specialties, Inc*.

1. Baby Changing Station shall be horizontal format and shall protrude no more than 4 inches (102 mm) from wall when in retracted position.

2. Unit shall comply with 2010 ADA Accessibility Standards, ASTM F2285-04, and EN 12221-1.

3. Unit shall support a static load of 300 lbs. (136.1 kg) and be tested in excess of 350 lbs. (158.8 kg).

4. Unit shall be fabricated of non-porous plastic (FDA approved HDPE) tested according to ASTM G21 and ASTM G22.

5. Unit shall contain a door facing and wall flange dress trim of satin finished 18 gauge type 304 stainless steel.

6. Unit shall contain a surface mounting collar made from satin finished 22 gauge type 304 stainless steel.

7. No parts of the operating mechanism shall be accessible when unit is open or closed to provide a tamper-resistant and pinch proof user environment.

8. Unit shall have a damped gas spring to assist user in opening and closing bed tray with the use of one hand. Unit shall be provided with one integral heavy-duty bag hook.

9. Unit shall provide a bed-liner dispenser that may be easily converted to a multi-fold towel dispenser with no adapters.

10. Unit shall provide graphics and instructions in four languages on interior back.

11. Unit shall be provided with an adjustable two-part vinyl coated child protection safety-strap mounted with concealed fasteners on high walls of cradle.

12. Entire unit shall be assembled of completely sealed components to provide easy cleaning and no penetration zones to harbor microbes or bacteria.

13. Unit shall mount on standard stud wall dimensions and with proper anchoring may mount on all suitable wall constructions. Mounting fasteners shall be concealed after installation using color matched recess plug-covers supplied.

14. Unit bed tray and back shall be light grey in color and entire unit shall be recyclable at end of usable life. Unit shall be warranted for five (5) years against defects in material or workmanship.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.

B. Verify reinforcement and anchoring devices are correct type and are located in accordance with shop drawings.

C. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

D. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

E. For electrically-operated accessories, verify that electrical power connections are correct amperage, ready and in the correct locations.

F. Refer to Section 061000 and Section 092900 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install toilet accessories plumb and level in accordance with shop Drawings and manufacturer's printed installation instructions.

B. Locate toilet accessories at heights and locations required for compliance with local accessibility regulations, ICC A117.1 - Accessible and Usable Buildings and Facilities 2017 and the Americans with Disabilities Act.

3.04 CLEANING

A. Remove manufacturer's protective vinyl coating from sight-exposed surfaces 24 hours before final inspection.

B. Clean surfaces in accordance with manufacturer's recommendations.

3.05 PROTECTION OF INSTALLED PRODUCTS

A. Protect products from damage caused by subsequent construction activities.

B. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 104400 – FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Accessories.

1.02 RELATED WORK

A. Related work specified in other sections of the specifications:

1. Section 042000 – Unit Masonry
2. Section 055000 – Metal Fabrications
3. Section 061000 – Rough Carpentry
4. Section 099000 – Painting

1.03 CONTRACT DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to the work of this section.

1.04 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for portable fire extinguishers.

B. Fabricated materials must be the product of a manufacturer known as experienced and able in the specialty trade involved, and the manufacturer shall be approved by the Architect. Provide fire extinguishers. cabinets. and accessories by single manufacturer.

C. All work is to be executed by skilled mechanics and shall be of the finest quality, neat in appearance, and free of defects.

D. Installation shall be made by the manufacturer or by his licensed or franchised representative who shall be approved by the Architect.

1.05 REFERENCES

A. NFPA 10 - Portable Fire Extinguishers
B. ADA Accessibility Guidelines
C. UBC Standard 7-5 (ASTM E-814-83) - Fire-rated cabinet option for combustible and non-combustible walls.

1.06 SUBMITTALS

A. Shop Drawings: Submit complete an accurate shop drawings, details, or illustrated literature to the Architect for approval. No installation shall be made without the prior approval of the Architect.

B. Manufacturers Product Data: Submit manufacturers product literature for both extinguishers and cabinets in accordance with Section 013300.

1.07 JOB CONDITIONS

A. Take and verify all measurements required for the proper execution and fit of the work at the building before starting fabrication or erection and examine the nature of material to which work is to be attached.

B. The Contractor will be responsible for the proper attachment of work furnished under this section and for the work of other trades related to it.

PART 2 - PRODUCTS

2.01 APPLICABLE MANUFACTURERS

A. Where shown on the drawings, provide fire extinguishers. cabinets, accessories manufactured by the following or architect approved equal:

Larsen's Manufacturing Co.,
7421 Commerce Lane N.E.
Minneapolis, MN 55432
(763) 571-1181 or (800)527-7367

2.02 MATERIALS

A. Fire Extinguishers:

1. Furnish and install Multi-Purpose dry chemical fire extinguishers similar or equal to **Model MP5-A**.

2. Body of extinguishers shall be red enameled steel, approximately 16 inches high, 4-1/4 inches in diameter, and weighing approximately 9 lbs. Each extinguisher shall be provided with chrome plated valves, color code nozzles, pressure indicating gauges, charging adaptors, moisture traps, metal pull rings complete with chain, and all other accessories required for a complete installation including metal wall brackets for units not encased in cabinets.

3. Dry chemicals for extinguishers shall be specially fluidized and siliconized mono ammonium phosphate prepared as a multi-purpose product developed for the use of Class A, B, and C fires.

4. Fire extinguishers indicated on drawings not provided with cabinets shall be wall hung on metal brackets from which extinguishers shall be hung. Fire extinguishers shall be installed at height recommended by OSHA and in coordination with ADA guidelines.

5. Fire extinguishers for kitchens shall be equal to **Model No. WC-6L** as produced by Larsen’s Manufacturing Company. Extinguishers to be wall hung on brackets equal to Model No. B1, also by Larsen’s. Wet chemicals for fire extinguishers shall be developed for the use of class “A” and “K” fires. Provide and install as described above.

6. Fire extinguisher units shall be of type approved by the National Board of Fire Underwriters' Standard No. 299, the requirements of the Occupational Safety and Health Administration, and all other local codes and authorities having jurisdiction over same, and they shall bear the necessary labels of the Underwriters' Laboratories, Inc.

7. Fire extinguishers shall have a dial to indicate air pressure.

8. All fire extinguishers shall be of manufacture approved by the Architect.

9. The required quantity, and location of fire extinguishers shall be as shown on the drawings.

10. All fire extinguishers shall be fully charged and left ready for operation.

B. Fire Extinguisher Cabinets:

1. Fully recessed type fire extinguisher cabinets shall be Architectural Series **Model No. FS2409-R1** Fire Rated Cabinet as manufactured by Larsen Manufacturing Company, or equal as approved by the Architect.

2. Semi recessed type fire extinguisher cabinets shall be Architectural Series **Model No. FS2409-R3** Fire Rated Cabinet as manufactured by Larsen Manufacturing Company, or equal as approved by the Architect.

3. Fire extinguisher cabinets shall be fabricated with steel doors. Doors shall be *"Vertical Duo-Panel" style* with clear tempered safety glass and red vertical die cut lettering reading “Fire Extinguisher”.

C. Accessories:

1. Fire Blankets and Cabinets – Provide in all science and shop room locations and additionally where indicated on drawings.

2. Extinguisher Brackets.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that rough openings for cabinets are correctly sized and located.

3.02 INSTALLATION

A. Install the items of this Section in strict accordance with the original design, approved shop drawings, and requirements of agencies having jurisdiction, as approved by the Architect, and approved shop drawings, anchoring all components firmly into position.

B. Installation shall maintain fire rating of partitions requiring same.

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 105114 – FULLY-WELDED ATHLETIC LOCKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to work of this section.

B. Related Work Described Elsewhere:

1. Section 033000 – Cast-in-Place Concrete
2. Section 061000 – Rough Carpentry
3. Section 062000 – Finish Carpentry

1.02 SCOPE

A. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not necessarily limited to, the following:

1. Fully-Welded, Ventilated Athletic Lockers where shown on the drawings.
2. All required accessories, metal closures, trim, and accessories where required.
3. Locking mechanism and locking devices for all lockers.
4. Wood furring, blocking or trim as may be required by drawings or the manufacturer for the complete and proper installation of the lockers and accessories shall be included with this installation.

1.03 GENERAL PROVISIONS

A. Delivering and Handling: Deliver all materials in unopened original containers bearing manufacturer's labels. Handle all materials with proper care to prevent damage.

B. Cleaning: At all times during the progress of the work, keep all parts clean and remove all rubbish and debris caused by the work of this section and leave the entire installation in presentable and orderly condition.

C. Defective Work: All defective, damaged, defaced, or other work of substandard quality will be rejected by the Architect and replaced with new work in accordance with the specifications, without extra cost to the Owner.

1.04 QUALITY ASSURANCE

A. Manufacturing Standard: Provide metal lockers that are standard products of a single manufacturer, with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings.

B. Fabricator Qualifications: Firm experience (minimum 10 years) in successfully producing the type of metal lockers indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

C. Installer Qualifications: Engage an experienced (minimum 10 years) installer who has successfully completed installation of the type of metal lockers and extent to that indicated for this project.

1.05 SHOP DRAWINGS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures, and as modified below.

B. Submit complete and accurate shop drawings, details, or illustrated literature to the Architect for approval, in strict accordance with applicable requirements of the contract documents.

C. Shop drawings: Submit drawings showing locker types, sizes, quantities, including all necessary details relating to anchoring, trim installation and relationship to adjacent surfaces.

D. Color charts: Provide color charts showing manufacturer's available colors (minimum 24). Provide metal samples if requested.

E. Numbering: Locker numbering sequence shall be coordinated with the Owner and noted on approved shop drawings returned to locker contractor.

F. Locker combination listing and master keys: Coordinate and deliver with the Owner.

1. No installation shall be made without prior approval of the Architect.

1.06 PRODUCT HANDLING

A. All work shall be fabricated in ample time so as to not delay construction process.

B. All materials shall be delivered to the site at such a time as required for proper coordination of the work. Materials are to be received in the manufacturer's original, unopened packages and shall bear the manufacturer's label.

C. Do not deliver / install lockers until building is enclosed and ready for locker installation. Protect from damage during delivery, handling, storage, and installation. Store all materials in a dry and well ventilated place adequately protected from the elements.

1.07 MEASUREMENTS

A. Take and verify all measurements required for the proper execution and fit of the work at the building before starting fabrication or erection and examine the nature of material to which the work of this section will be attached.

1.08 GUARANTEE

A. Lockers shall be covered against all defects in materials and workmanship excluding finish, damage resulting from deliberate destruction and vandalism under this section for the lifetime of the facility.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Available Manufacturers: Subject to compliance with the design, material, method of fabrication and installation as required in this specification section or modified as shown on drawings. Manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Art Metal Products - (Basis of Design) Bulldog.

2. DeBourgh
3. GSS

2.02 LOCKER MATERIAL

A. Corridor Locker Style: AMP – 1004 Bulldog twin frame all welded athletic locker.

1. Configuration: Single Tier, Double Tier, Triple Tier or as indicated on the Drawings.

2. Column Size: Coordinate with the Construction Documents.

3. Lock Type: Master 1525 – Pad Lock (Bid shall include an additional 50 replacement locks)

4. Color: Frame and Body as selected by Architect

5. Ventilation: Doors to be secure air-flow with full height door stiffener with diamond perforated sides.

6. Number of Locker Columns: Coordinate with the Construction Documents.

7. Number of Locker Openings: Coordinate with the Construction Documents.

8. 5% of total locker quantity shall be ADA compliant and evenly dispersed.

B. Steel: All sheet steel used in fabrication shall be prime grade free from scale and imperfections and capable of taking a heavy coat of high gloss baked enamel.

C. Fasteners:

1. General: Cadmium, zinc or nickel plated steel; bolt heads, slotless type; self locking nuts or lock washers.

D. Hardware:

1. Equipment: Hooks and hang rods of cadmium plated or zinc plated steel or cast aluminum.

2. Handle: Seamless drawn stainless steel recessed handle.

3. Number Plates: To be polished aluminum with not less that 3/8" high etched numbers attached to door with two aluminum rivets.

2.03 FABRICATION

A. General: All lockers shall be factory-assembled, of all MIG welded construction, in multiple column units to meet job conditions. Assembly of locker bodies by means of bolts, screws, or rivets will not be permitted. Welding of knockdown locker construction is not acceptable.

B. Finishing: All locker parts to be cleaned and coated after fabrication with a seven stage zinc/iron phosphate solution to inhibit corrosion, followed by a coat of high grade enamel electrostatically sprayed and baked at 325°F for a minimum of 30 minutes to provide a tough durable finish. Color to be selected from manufacturer’s standard list of colors.

1. Two-Tone Color Combination: Shall be at no additional cost with the locker frame and trim chosen from one color and the doors may be one of any other color. Refer to Drawings for finish selection.

2. Provide Optional Special textured Hammer Finish. Paint thickness approx. 4 Mills thick. Color to be selected from Sherwin Williams paint Selections; when indicated on the Drawings.

C. Twin Frame/Vertical Side Panels: Shall be of integral frame and side wall construction manufactured from 16 gauge sheet steel. The one-piece side/frame shall be formed to provide a continuous door strike on the hinge side. An additional continuous vertical door strike shall be achieved at the latch side by MIG welding a 16 gauge full height channel frame member to the integral locker side producing a rigid torque-free welded locker body. The frame shall include a tab which engages a slot in the base locking the side panel and frame into position. Sides to be solid.

D. Wardrobe Doors: Outer door to be fabricated from single sheet prime 14 gauge with single bends at top and bottom and double bends at the sides with a 3-1/2" wide 18 gauge full height channel door stiffener spot welded to the inside of door face and MIG welded to the hinge side of the door as well as to the top and bottom door return bends to form a rigid torque-free box reinforcement for the door. **Lockers that do not have stiffener's welded to the hinge side of the door, top, bottom, and door pan will not be accepted**. Door Style: Secure air flow louver.

E. Seamless Drawn Stainless Steel Recessed Locker Handle: All locker doors shall have a **seamless drawn** stainless steel (Type 304) recessed handle shaped to receive a padlock or built-in combination lock. The recess pan shall be deep enough to have the lock be completely flush with the outer door face. A finger lift/padlock hasp shall protrude through the top of the handle for easy opening of the locker door.

F. Latch Assembly: Shall be **single point rigid non-moving positive latch by means of a heavy 11 gauge (minimum) latch securely welded to the 16 gauge vertical frame member at both the continuous door strike as well as the integral locker side to prevent the latch and frame from twisting.** The latch assembly must be through the recess pan. The latch must be able to accept either a padlock or built-in combination lock. A pry resistant lug which inserts into the door shall be an integral part of the 11 gauge latch. Rubber bumpers shall be securely attached to the door strike.

G. Door Hinges: Hinges for wardrobe and gym doors shall not be less than 16 gauge **continuous piano type**, securely riveted to frame and welded to the door. All doors shall be right hand side hinged. **(2"/ 5 knuckle hinge not acceptable).**

H. Hat Shelves Intermediate Shelves & Bottoms: Shall be 16 gauge sheet steel, have double bends at front and shall have MIG welded to the side.

I. Backs: Shall be 18 gauge cold rolled sheet steel, be continuous to cover a multiple framed unit and be welded to each vertical side panel.

J. Locker Accessories

1. Locks: Combination padlocks with 5 master keys.

2. Finished End Panels: Shall be "boxed" type formed from 16 gauge cold rolled steel with 1" O.D. double bends on sides and a single bend at top and bottom with no exposed holes or bolts. Lockers with slope tops will have end panels formed with slope at top to cover the ends of the slope tops. Finish to match lockers. Provide at all exposed ends.

3. Fillers: Provide where indicated and/or required, of not less than 16 gauge sheet steel, factory fabricated and finished to match lockers.

4. Sloped Tops: Lockers for this project shall have sloped tops, 16 gauge sheet steel, factory fabricated & finished to match lockers.

5. Solid End Panels at Corners and Filler Locations: Install solid sheet steel side panels to locker sides at corners and beside front filler locations to prevent personal articles from being trapped in void at these locations.

K. Number Plates: Each locker shall have a polished aluminum number plate with black numerals not less than ½" high. Plates shall be attached with rivets to the lower surface within the recessed handle pocket.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Upon removal of existing lockers, Contractor shall notify Architect to inspect substrate condition. No installation shall proceed without Architect's approval. The Contractor shall remove and replace any unsatisfactory sleepers and/or blocking at Architect's direction or as conditions require.

3.02 INSTALLATION

A. Installation shall be made by the manufacturer or a licensed representative approved by the Architect.

B. All work is to be executed by skilled mechanics and shall be of the finest quality, neat in appearance and free from defects

C. Locker installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.

D. Lockers shall be set in place, plumb, level, rigid, flush and securely attached to the wall (or bolted together if back-to-back) and anchored to the floor or base according to manufacturer's specifications.

E. Lockers shall be anchored at each bank end and 12" o.c. at two points. Space fasteners at 36" O.C. or less as recommended by manufacturer to avoid metal distortion. Use fasteners appropriate to load and anchoring substratum. Use reinforcing plates wherever fasteners could distort metal.

F. Various trim accessories where shown such as sloping tops, fillers, bases, recess trim, etc., shall be installed using concealed fasteners. Flush, hairline joints shall be provided at all abutting trim parts and at adjoining surfaces.

3.03 ADJUSTMENT

A. Upon completion of installation, inspect lockers and adjust as necessary for proper door and locking mechanism operation. Touch up scratches and abrasions with factory-supplied paint to match original finish.

END OF SECTION

DIVISION 11 – EQUIPMENT

SECTION 11120 - PARKING CONTROL EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install complete parking barrier arm systems, fully commissioned, integrated, and functioning, and with all required components to such end whether or not specified herein.

1.02 SECTION INCLUDES

A. Parking gates and operators
B. Electric gate operators
C. Sensors and controls
D. Accessories

1.03 RELATED SECTIONS

A. Section 02831/02832 – Chain Link Fencing
B. Section 03300 – Cast-in-Place Concrete Work
C. Section 13129 – Prefabricated Aluminum Building
D. Division 16 – Relevant electrical sections

1.04 REFERENCE

A. Underwriters Laboratories (UL): UL 325 – Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.
B. Canadian Standards Association (CSA): CSA C22.2 No. 247.
C. Underwriters Laboratories (UL): UL 991 – Standard for Tests for Safety Related Controls Employing Solid-State Devices.
D. American Society Testing Materials (ASTM): ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.
E. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 – Industrial Control Systems: Enclosures.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300 – Submittals.

B. Product Data: Manufacturers data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements.
3. Installation methods.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge connections, and accessories.

1. Operation, installation, and maintenance manuals including wire diagrams.

2. Risers, layouts, and special wiring diagrams showing any changes to standard drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions and industry standards.

B. Store products indoors in manufacturer's original containers and packaging with labels clearly identifying product name and manufacturer. Protect from damage.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Substantial transformation and final assembly shall occur in the United States of America per Section 1605 of the ARRA-09.

B. Installer Qualifications: Installation performed by factory authorized dealer contractor specifically trained in gate operator systems of the type found within this section.

1. Provide documentation of maintenance and repair service availability for emergency conditions.

2. Provide quarterly maintenance for one year following Substantial Completion of the Project.

1.08 WARRANTY

A. Manufacturers standard five (5) year warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: DoorKing, Inc.; 120 S. Glasgow Ave; Inglewood, CA 90301; Toll-Free Tel: 800-826-7493; Tel: 310-645-0023; Fax: 310-641-1586; Email Eastern United States: ghendrix@doorking.com; Email Western United States: ndinnel@doorking.com; Web: doorking.com.

1. DoorKing Model 1601, including Remote Call Station with DX Prox card reader 1838-124.

B. Requests for equivalents will be considered in accordance with the Instructions to Bidders section.

2.02 PARKING/BARRIER GATE OPERATORS

A. Microprocessor based solid-state control board interacting with card readers, RF transmitters, access control system, other activating devices as required, including activation from new security booth, external devices for pedestrian sensing (photo-eyes) and vehicle (loop) sensing systems. Control board shall include built-in down

timer (1-25 seconds), built-in ports for two (2) plug-in loop detectors, Up input memory buffer, down command options, programming switches to set various operating modes, PAMS sequencing inputs (Perimeter Access Management System), inherent current sensing reverse system.

1. Compliance: Compliant to UL 325, UL 991 and CSA C22.2 No. 247 and listed by Intertek Testing Laboratories NA, Inc. (ETL), a Nationally Recognized Testing Laboratory.

    a. This model is intended for use in Class II, III and IV vehicular barrier gate applications.

2. Warranty: Five (5) year manufacturer's standard warranty.

3. Operator speed: 90-degrees in approximately 1.5 seconds.

4. Enclosure: 12 gage, 0.105 inch (2.6 mm) G90 hot-dipped galvanized steel, powder coated, full gloss smooth super TGIC, polyester white.

5. Configuration: Left or right hand mount. In the event of an obstruction close by the barrier gate, operator can be reversed to allow access to cabinet door.

6. Motor: 1/2 HP, continuous duty.

7. Gear Reduction: 60:1 worm gear running in a continuous oil bath with 360-degrees of gear travel.

8. Magnetic Limit Switches: No mechanical switches to wear out or break.

9. Operating Switches: Built-in power (on-off) and operating (up-down-normal) toggle switches.

10. Convenience Outlets: Two (2) 115 VAC for accessory transformers.

11. Electrical Power Requirements: 115/208/230/460/575 VAC.

    a. 208/230/460/575 VAC requires DoorKing High Voltage Kit.

12. Gate Arms: Fully retroreflectorized on both sides, vertical stripes alternately red and white at 16-inch intervals as required by the Manual on Uniform Traffic Control Devices (MUTCD).

  a. 14-foot, 3-inch round aluminum.

13. Pedestrian Protection

    a. Photo-electric eye / auxiliary loop detector relay switch.

1. Requires DoorKing 9411 loop detector used in conjunction with photo-eye.

14. Accessories: Provide the accessories listed below.

    a. Arm Breakaway Kit.
    b. Thermostatically controlled fan kit.
    c. Thermostatically controlled heater kit.
    d. Plug-in loop detectors.
    e. Electric reversing edge – reverses rotation of arm on contact with an obstruction.
    f. Gate Tracker Expansion – provides time and date stamped electronic record of cycles, input errors, loop detector input errors, obstruction hits and power cycles.
    g. Convenience Open System – arms automatically open with power failure.

15. Video intercom: System may be provided by others, but must be able to be integrated into call station and mounting post.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Do not begin installation until substrates and environs are acceptable. Commencement of installation constitutes acceptance of conditions.

B. Notify Architect in writing of unsatisfactory conditions before proceeding.

3.02 INSTALLATION

A. Layout, excavate, form required footing, and set all required conduit.

B. Footing shall be 3,500psi reinforced poured concrete, extending 36” below finished grade, 4” above finished grade, and 24”x24” square.

C. Install all barrier system components in accordance with manufacturer’s installation instructions.

    1. Installer is responsible for complete functionality and all wiring and low voltage components beyond the basic line voltage supply and termination by the Division 16/17 contractor.

D. Install vehicle detection loops.

E. Integrate any required external systems including possible video intercom system provided by others. Installer shall endeavor to cooperate and integrate to the barrier system.

F. Provide devices for, and integrate entrance gate controls at new security booth.

G. Test for proper operation and adjust until satisfactory results are obtained.

3.03 PROTECTION

A. Protect installed products until completion of products.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.04 MAINTENANCE

A. Provide owner with two (2) copies of operation, installation and maintenance manuals including typical wiring diagrams.

B. Provide owner with two (2) copies of risers, layouts, and special wiring diagrams showing any changes to standard wiring diagrams.

END OF SECTION

DIVISION 12 – FURNISHINGS

SECTION 122400 – MANUAL OPERATED ROLLER SHADES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manually operated, roll-up fabric interior window shades including mounting and operating hardware as shown on the drawings.

B. The required applications of roller shades includes the following:

1. All window units, unless otherwise noted.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to work of this section.

B. Related sections:

1. Section 061000 – Rough Carpentry, Blocking for support of window shade hardware.

1.03 REFERENCES

A. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

B. GREENGUARD Environmental Institute Gold.

C. ANSI/WCMA A100.1-2018.

1.04 SUBMISSIONS

A. Comply with requirements of Section 013300 – Submittal Procedures and as modified below.

B. Product Data: Manufacturer's data sheets on each product specified, including:

1. Preparation instructions and recommendations.
2. Installation and maintenance instructions.
3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
4. Storage and handling requirements and recommendations.
5. Mounting details and installation methods.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

E. Selection Samples: For each finish product specified, one complete set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.

G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

H. Standard manufacturer's defect warranty: Standard manufacturer's warranty documents indicating compliance with requirements of Section 1.9 below.

I. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section. If manufacturer does not meet minimum experience requirement please submit life cycle test data showing minimum 2000 complete operational cycles for each year of warranty showing no failure and that shade remains fit for use as a operable shade).

B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use. Show complete manufacturer data (name,location,contact) and certification from manufacturer that the fabrics sourced for this project comply with the test data provided.

C. Mock-Up: Provide a mock-up of one of each type roller shade assembly specified for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window(s) designated by Architect.
2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Label containers and shades according to Window Shade Schedule.

D. Store products in manufacturer's unopened packaging until ready for installation. Store shades in a well ventilated, dry, approved location, and protect from damage; damage shades due to improper protection during storage shall be rejected and removed from site.

1.07 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions

are maintained at levels recommended for project upon completion.

B. Prior to shade installation, building shall be enclosed. Interior temperature shall be maintained between 60ºF and 90ºF during and after installation; relative humidity shall not exceed 80%. Wet work shall be complete and dry.

C. Notify Architect in writing of any conditions that will prevent satisfactory installation of window blinds. Beginning of window blind installation indicates acceptance of conditions and Contract shall bear responsibility for any unacceptable finished installation caused by these conditions.

1.09 WARRANTY

A. Hardware and Shade Fabric: Draper® standard twenty-five year limited warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For convenience and as a basis of required quality, details and specifications have been based on manual operated roller shades as manufactured by Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425; Spiceland, IN 47385-0425. ASD. Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Web: www.draperinc.com. In no way shall this be construed as limiting competition; products of other manufacturers may be proposed to the Architect, in accordance with the provisions of the Contract.

2.02 MANUAL-OPERATED ROLLER SHADES

A. Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Clutch-operated FlexShade® as manufactured by Draper, Inc.

B. Fabrics:

1. All specified fabrics shall meet or exceed the following:

   a. ASTM E-84: Flame spread rating not to exceed 0-25; smoke development rating not to exceed 450.
   b. Federal Standard 191 Method 5903.
   c. New York State Uniform Fire Prevention and Building Code.
   d. Flame-resistance two seconds after flame maximum with average char length of not more than 2-1/2” in. both warp and fill directions. Must meet U.S. Government specification CCC-C521E, Type II Fiberglass (Opaque).
   e. NFPA 701: Standard Methods of Fire Tests For Flame Propagation of Textiles and Films.

2. The shades shall be composed of a textured fabric, woven from spun glass fibers. Finished weight shall be no less than 12 ounces per square yard, impregnated with a vinyl coating. Window shade fabrics shall be selected from the Phifer Shearweave 2500 (1% open mesh) line of shear weave fabrics of varying opacity and color, and be fully washable with repeatedly scrubbed dampened cloth or sponge with mild detergent. All specified fabrics shall be fade resistant and stain resistant. (No perceptible changes on color after 200 hours in Fade-O-Meter).

3. Provide complete range of shear weave fabrics available in colors and density.

C. Chain/Clutch Operator: Gear box, of die cast aluminum and steel, has ratio of 3.01 to 1. Bi-

directional to mount at either end of roller. Chain assembly, of stainless steel heavy-duty chain. Length as required to operate shades.

D. Rollers: 2: diameter x .080 wall extruded aluminum.

E. Mounting brackets: 1018 plated steel universal brackets for wall mounting.

F. Slat: 1/8” x 1” aluminum encased in heat-seamed hem.

G. End Caps: 4 ½” x 4 ½” steel.

H. Dual Roller System: Accepting two (2) shades within a single pocket style headbox.

I. All hardware shall be of heavy-duty quality and shall be chrome plated.

J. The finished shade shall be of a width sufficient to adequately cover the roller. None of the barrel shall be exposed at the end of the roller.

K. Fascia panels and end brackets: All specified roller shades shall be installed with fascia panel and end brackets.

L. Installation Brackets: shall be corrosion-resistant metal, free from burrs and rough edges.

M. Provide (1) length of operable roller-shade per each section of window unit or as directed by the Architect. Roller shade length shall not exceed 60”, provide multiple roller shade sections for lengths that exceed 60”.

N. The Architect shall select the shade fabric color(s) from the manufacturer’s style SheerWeave® Series SW2500 by Phifer®: 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave.

1. Fire rating: California U.S. Title 19 (small scale),
2. NFPA 701 TM#1 (small scale),
3. NFPA 101 (Class A Rating),
4. IBC Section 803.1.1 (Class A Rating),
5. BS 5867 Part 2 Type B Performance,
6. NFPA 701 TM#2 (large scale),
7. CAN/ULC-S 109 (large and small scale),
8. CAN/CGSB2-4.162-M80. Bacteria and fungal resistance:
9. ASTM E 2180, ASTM G21, ASTM G22, AATCC30 Part 3, ASTM D 3273,
10. UL GREENGUARD® Mold and Bacteria Standard ASTM 6329; includes Microban® antimicrobial additives.
11. Environmental certification: Certified to UL GREENGUARD and GREENGUARD Gold® standards for low chemical emissions into indoor air during product usage. Safe use: RoHS/Directive 2002/95/EC,
12. US Consumer Product Safety Commission Section 101 and ANSI/WCMA A 100.1-2007 for lead content and REACH (EC 1907/2006) compliant.
13. 1 percent open, .024 inches thick. 16.39 oz/square yard

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

B. Coordinate requirements for blocking, construction of shade pockets, and structural supports to ensure adequate means for installation of window shades.

C. Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings specified in Section 095000.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Shade pockets:

1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
3. Install corner pieces securely and in alignment with pockets.
4. Install pocket ends securely and in alignment with pockets.
5. After interior construction is essentially complete, install shade and operating mechanism in pocket.

D. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.

1. Fascias.
2. Closure panels.
3. Endcaps

E. Install headbox, side channels, and sill channel with sealant specified in Section 079200 - Joint Sealants to eliminate light leaks at perimeter of shade system.

F. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

G. Provide adequate clearance to permit unencumbered operation of sash hardware.

H. Divisions between shades are permitted only at mullions by continuous windows or openings where more than on blind for one opening occurs, unless otherwise indicated.

I. Isolate metal parts from concrete and mortar to prevent galvanic action. Use tape or thick coating or other means recommended by manufacturer to effect separation.

J. Clean finished installation of dirt and finger marks. Leave work area clan and free of all debris.

3.04 TESTING AND DEMONSTRATION

A. Test window shades to verify that operating mechanism and other operating components are functional. Correct deficiencies.

   1. Chain and clutch.

B. Demonstrate operation of shades to Owner's designated representatives.

3.05 PROTECTION

A. Protect installed units to ensure their being in operation condition, without damage, blemishes, or indication of use at completion of project. Repair or replace damaged units as directed by Architect.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

DIVISION 12 – FURNISHINGS

SECTION 123200 – LABORATORY WOOD CASEWORK AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS and SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 096519 – Resilient Flooring
4. Section 220500 – Basic Materials and Methods
5. Section 230500 – Basic Materials and Methods
6. Section 260500 – Basic Materials and Methods

B. This section includes, but is not limited to:

1. Fixed modular casework furniture with finished interiors
2. Countertops
3. Fixtures
4. Sinks, faucets and plumbing accessories
5. Electrical fixtures and accessories
6. Fume hoods
7. Utility-space closure panels between base cabinets and at end exposed ends of utility spaces
8. Utility-space framing at backs of base cabinets and between backs of base cabinets
9. Related equipment

1.02 QUALIFICATIONS

A. All laboratory equipment covered by this specification and accompanying drawings shall be manufactured or furnished by one manufacturer and supplied under his direction to eliminate any divided responsibility.

1.03 QUALITY ASSURANCE

A. Products of Campbell Rhea are specified as a basis of design, quality, and layout. The specifications and drawings define and show the material or manufacturer is specified, it is not the intent to discriminate against any product of another manufacturer. However, it is the intent of this specification to provide for the Owner a quality, functional installation of laboratory equipment and casework, and to exclude inadequate or inferior laboratory equipment and casework.

B. Manufacturer Qualifications: Not less than five (5) years experience in the actual production of specified products.

C. Installer Qualifications: Firm with min. five (5) years experience in installation or application of systems similar in complexity to those required for this project.

D. Mock-Up: Provide a mock-up for evaluation of fabrication techniques and application workmanship.

1. Installation in area designated by Architect.
2. Do not proceed with remaining work until installation is approved by Architect.

1.04 WORK BY LABORATORY EQUIPMENT CONTRACTOR

A. Furnishing, delivering to the building, uncrating, setting in place, leveling, and anchoring all casework and equipment listed in the specifications or equipment schedule and/or shown on the drawings.

B. Furnishing plumbing fixtures (faucets, gas cocks/turrets, side mount eyewashes, etc.) and fittings as defined in the specifications and/or as shown on the drawings, complete with tank nipples and lock nuts for mounting fixtures and fitting on tops or curbs. Installation will be by other respective trades as part of their final connections.

C. Furnishing electrical service fixtures directly attached to the casework or equipment as defined in the specifications, equipment list, and/or shown on the drawings. Fixtures supplied only, not attached or assembled. Installation will be by other respective trades as part of their final connections.

D. Furnishing and installing sink bowls and cup sinks, complete with required overflows, plugs, strainers and tail pieces as defined in the specifications, equipment list, and/or shown on the drawings. Final connections of drain piping and venting will be by other respective trades.

E. Furnishing and installing filler panels and scribes as required for finished installation.

F. Removal of all debris, dirt, and rubbish accumulated as a result of installation of this equipment, leaving premises broom clean and orderly.

G. Store products in manufacturers unopened packaging until project conditions are ready for installation.

H. Factory cut out for all sinks, core drilling for all services and grommets in epoxy resin tops.

1.05 WORK BY OTHERS

A. Furnishing, installing, and connecting of all service lines, drain lines, piping, and conduit within equipment and fume hoods, in service turrets or tunnels through, under, or along the backs of working surfaces, and in reagent racks above countertops as required by specifications and/or drawings.

B. Furnishing, installing, and connecting all ductwork from fume hoods to blowers and from blowers to final point of discharge to atmosphere. Unless otherwise specified, blower shall be furnished and installed by Mechanical Contractor.

C. Furnishing, installing, and connecting all vents, revents, steam fittings, and special plumbing fixtures or piping to meet local codes, even though not specifically called for in the specifications and/or shown on the drawings.

D. Furnishing and installing of all rigid or flexible conduit, wire, pulling of wire, fittings, and special electrical equipment and accessories, including boxes, receptacles, and flush plates sent loose. Included are those in box curbs or tops, which are not installed at equipment contractor's plant due to inconvenience of shipping. All shall be in accordance with local codes even though not specifically called for in the specifications and/or shown on the drawings. Wiring and connection of switch to fume hood lights and blower motors.

E. Providing all framing and reinforcements of walls, floors, and ceilings necessary to adequately support the equipment and all bucks and plaster grounds required for proper installation of equipment.

F. Unless otherwise noted on drawings, all perimeter rubber cove base.

1.06 SUBMITTALS

A. Submit the following in accordance with General Conditions of contract specifications and Specification Section 013300 – Submittal Procedures.

B. Manufacturers product data sheets on each product to be used, including,

1. Test reports certifying that the casework finish complies with SEFA-8 standards for chemical and physical resistance performance requirements.
2. Performance test reports from an independent testing lab on each specified top material.
3. Preparation instructions and recommendations
4. Storage and handling requirements and recommendations
5. Installation instructions.
6. Operation and maintenance data

C. Shop Drawings: Include plans, elevations, sections, details and attachments to other work.

1. Indicate locations of blocking and reinforcements required for installing laboratory casework.
2. Indicate locations and types of service fittings, together with associated service supply connection required.
3. Include details of utility spaces.
4. Include indicators of exposed conduits, if required, for service fittings.
5. Indicate locations of and clearances from adjacent walls, doors, windows and other building components, and other laboratory equipment.
6. Include coordinated dimensions for laboratory equipment specified in other Sections.
7. Include dimensioned utility rough-in plans.
8. Include countertops showing sizes, shapes, edge and backsplash profiles, cutouts for plumbing fixtures and methods of joining.

D. Selection Samples: Include plans, elevations, sections, details and attachments to other work.

1. Samples for initial selection purposes of manufacturers color charts showing the full range of colors, textures and patters for each type of material included in this specification.

2. Samples for verification purposes must be based on the following specifications and not a “manufacturers standard” product. Upon request of the architect, samples must be submitted within thirty (30)-days and may be held until project completion. Samples that may be required are as follows:

a. Combination hot water, cold water and gas vandal resistant, solid cast service fixture.
b. Full size base cabinet with door and drawers – 24” x 22”w x 36”h.
c. Full size upper cabinet with solid hinged door – 24” x 12”d x 30”h.
d. 12”x12” resin countertop

E. Certificate of Origin: Manufacturer must supply with first submittal, an example of their Certificate of Origin declaring casework is wholly manufactured and assembled in the United States.

1.07 MAINTENANCE AND OPERATING INSTRUCTIONS

A. The Contractor shall include in his/her bid the cost of providing a technically qualified representative for a period of one (1) day to thoroughly instruct the Owner's personnel in correct procedures of operating and maintaining this contract.

1.08 PROJECT CONDITIONS

A. For delivery and installation of laboratory casework and equipment, building conditions shall comply with the following AWI Standard 1700-G-3 and 1700-G-4:

1. Flooring required to be placed under casework and equipment installed.
2. Wood or metal blocking (wall grounds) installed within partitions to allow for immediate installation upon delivery.
3. Overhead mechanical, electrical and plumbing rough-in work is complete.
4. Wet operations complete prior to delivery.
5. Ceiling grids (with or without ceiling tiles), overhead soffits, ductwork and lighting installed.

1.09 WARRANTY

A. Casework Manufacturer Warranty: 3 years from date of delivery. Warranty is for the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly investigate and address said deficiencies.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum SEFA 8 standards as certified by independent third party testing laboratory.
3. Within the warranty period, the manufacturer shall repair or replace defective casework.

B. Casework manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods. Casework manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Casework manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of casework; and, shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of their products.

1. The warranty with respect to products from another company sold by the casework manufacturer is limited to the warranty extended by that other company, but in no case be less than the duration stated in Specification Section 017000.

C. Casework manufacturer shall provide, with close-out documents, a Certificate of Warranty for products provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Specification: CampbellRhea, which is located at: 1865 N. Market St.; Paris, TN 38242; Tel: 731-642-4251; Fax: 731-642-4262; Web: www.campbellrhea.com

1. Acceptable alternate manufacturers:
   a. Sheldon Laboratory Systems
   b. Thermo/Fisher-Hamilton
   c. Or as approved by Architect and/or Owner

B. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes, similar door and drawer configurations, and complying with the Specifications, including certification to SEFA-8 standards for construction and chemical resistance, may be approved for substitution.

2.02 CONSTRUCTION

A. Solid lumber and wood veneer on plywood core.

B. Cabinet Finish, Interiors and Exteriors Match Finished:

1. Wood Species: Maple.

2. Finish: As selected by the Architect. Interior finish and color to match exterior.

C. Drawer Styles:

1. Signature Drawer Styling: Drawer fronts are 13/16 inch (20.6 mm) thick solid lumber and have a squared back edge and slight radius to the front edges. Drawers have horizontal grain.

D. Door Styles:

1. Signature Door Styling: Doors have 3/4” inch x 1-1/2” solid lumber stiles and rails with a squared back edge and slight radius to the front edges framing a particleboard core with vertical grain wood veneer face and back.

E. Door and Drawer Hardware Style:

1. Drawer and door pulls: AL-3: Extruded aluminum bow rod design.

2. Hinges: Heavy-duty, institutional type, 5-knuckle hospital tipped, made from 0.083 inch (2 mm) thick chrome plated steel. Hinge is semi-concealed, 2 3/4 inches (70mm) high and has off-set wings; each wing has 5 screw holes for the door leaf and 4 screw holes for the case leaf, two of which are slotted for adjustability. Hinges are attached with Euro screws.

3. Latching Handle: Latching handle CP LH-1 is chrome plated, 4 1/4 inches (108 mm) long and streamline in design. Handle operates with 1/4 turn. Double door cases have latching handles on the right door and dummy handles on the left door. A three point latching system provides a positive engagement at the top and bottom of the door with tapered aluminum rods, which pull the door snug when they engage plastic strike plates. The rods are 5/16 inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which engages the side of the case, or latches behind the left door on cases with double doors.

4. Locking Handle: Chrome plated locking handle is a latching handle with a lock mechanism incorporated into the handle head. On double door cases, the left door has a dummy handle, and the right door has the locking handle. Lock is laboratory grade with a 5-disc tumbler mechanism with a brushed chrome face. Tumblers and keys are brass, while the plug and cylinder is die cast zinc alloy. There are 500 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match.

5. Locks; Removable core standards: Lock CP SL-1 is laboratory grade, cylinder cam lock, with a 5-disc tumbler mechanism with a chrome plated face. Tumblers and keys are brass, while plug and cylinder is die cast zinc alloy. A 180-degree turn of the key moves the lock cam into, or out of, a slot cut to receive it. There are 500 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match. Lock CP SL-1 is equipped with a removable core, keying control. With the use of a control key, the key core of the lock assembly can be removed and a new key core inserted, changing the entire locking system in a matter of minutes. Key cores can be held out of the lock assembly until the project is completed,

removing the security risk of lost or stolen keys during installation and construction. Casework manufacturer shall provide control keys and replacement cores. Locks shall be furnished on all doors, drawers, etc. unless otherwise noted. Individual rooms shall be keyed alike, each room shall be keyed differently.

6. Drawer Slides: Full Extension: Drawer slides are zinc plated, cold rolled steel, heavy-duty with a 150 lb. load capacity. They are equipped with steel ball bearings for smooth effortless operation. Slides have automatic positive stop to prevent drawer's accidental removal, but allow for quick removal without tools.

7. File Drawer Slides: FD-1: Zinc plated, cold rolled steel, heavy-duty, side mounted, and have a 125 lbs (56.25 kg) load capacity. They are equipped with heavy-duty, ball bearing nylon rollers for smooth effortless operation. Slides are full extension with a positive stop, and a trigger finger release.

2.03 MATERIALS

A. Maple Lumber: Grade FAS or better, air-dried and kiln dried to 6 percent moisture content, then tempered to 7 to 8 percent prior to fabrication. Lumber exposed to view, is free of stains, splits, shakes, season checks and other similar defects. Other hardwoods are grade FAS or better, air dried to 6 percent moisture content, then tempered to 7 to 8 percent prior to fabrication. Other hardwoods are used in semi-exposed, or unexposed, areas and comply with NHLA grading for FAS or better lumber.

B. Maple Plywood: Plywood is rotary cut Maple, select grade A-1 cross-banded, and has a veneer core. The 1 inch (25 mm) or 3/4 inch (19 mm) plywood is a minimum of 7-ply, 1/2 inch (12 mm) is a minimum of 5 ply, 1/4 inch (6 mm) is minimum of 3 ply, and 3/32 inch (2.4 mm) is 3-ply. Other hardwood plywood is sound grade, has a solid core and is suitable for semi-exposed or unexposed areas. All plywood shall be CARB Phase 1 compliant.

C. Hardboard used in drawer bottoms and unexposed backs, consists of super-refined wood fibers and chips, highly compressed into a hard, dense, 1/4 inch (6 mm) thick, homogeneous sheet, faced with wood grain pattern melamine on the exposed face. Physical properties: Average MOR is 5,000 lbs/sq inches (3.5 kgf/sq mm); density is 48 lbs/cu ft (0.6 kg/cu m); and MOE of 500,000 psi (350 kgf/sq mm). All hardboard shall be CARB Phase 1 compliant.

2.04 FABRICATION

A. Units and configurations designated for accessibility by users shall comply with ATBCB ADAAG (ADA standards).

B. Design, material and construction of casework, shelving and tables shall comply with SEFA 8 performance and resistance standards.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for its intended use.

D. Base Cabinets: Base cabinets shall have a 2 1/4 inches (57 mm) by 1 inch (25 mm), solid hardwood horizontal front top frame member and 2 1/8 inches (54 mm) by 1 inch (25 mm), solid hardwood horizontal rear and side top frame members. Front intermediate rails are 3/4 inch (19 mm) by 2 1/2 inches (64 mm) solid wood. Back intermediate rails are furnished only when drawer separators are specified. Exposed exterior backs are 3/4 inch (19 mm) plywood. Cabinets with exposed interiors but unexposed exteriors have 1/4 inch (6 mm) plywood backs. Cabinets with unexposed interiors and exteriors have 1/4 inch (6 mm) thick hardboard with wood grained melamine face backs. Exposed end panels are 3/4 inch (19 mm) plywood. Unexposed end panels are 3/4 inch (19 mm)

hardwood plywood. End panels with unexposed interior and unexposed exterior are 3/4 inch (19 mm) hardwood plywood. Bottom, shelves, and dividers in cabinets with exposed interiors are 3/4 inch (19 mm) plywood; with unexposed interiors is 3/4 inch (19 mm) hardwood plywood. All intermediate cabinet shelves shall be 1 inch (25mm) finished plywood. Exposed edges of front top horizontal frame and intermediate rail members; end panels, bottom, shelves, and dividers are edged with 1/8 inch (3 mm) solid wood. Drawer separators, furnished only when specified, are 1/4 inch (6 mm) thick hardboard with wood grained melamine face.

E. Cabinet Construction: Cabinet construction shall have bored, doweled, dadoed, glued and screwed construction. Cabinets are enclosed without the use of common partitions. A full horizontal, mortise, tenon and glued, top frame is bored, doweled, glued, and reinforced with six (6) screws into the cabinet. Intermediate front rails and bottom rear horizontal parting rails are provided as required. Separators, where specified, are let into routed intermediate rails. Backs are recessed and encapsulated into dadoed end panels then screwed into the top and bottom case members. A standard enclosed toe space, 2-1/4 inches (57 mm) by 4 inches (102 mm) high, is provided, with toe rail bored, doweled and glued to end panels; however, casework cabinets, when in a library assembly such as a circulation desk, will have an enclosed toe space 2-1/4 inches (57 mm) deep by 6 inches (152 mm) high. Shelves are supported on heavy-duty, laboratory grade, twin pin plastic shelf clips, which fit into two double rows of holes drilled 1-1/4 inches (32 mm) on centers, in the case end panels for maximum shelf adjustability.

F. Wall and Upper Cases: Wall and upper cases shall have a 1 inch (25 mm) plywood top and bottom panel. Adjustable shelves are 1 inch (25 mm) finished plywood in cases with exposed interiors and 1 inch (25 mm) hardwood plywood in cases with unexposed interiors. Backs are 1/4 inch (6 mm) finished plywood in cases with exposed interiors and 1/4 inch (6 mm) thick hardboard with melamine face in cases with unexposed interiors. End panels in cabinets with exposed interiors are 3/4 inch (19 mm) finished plywood; end panels in cabinets with unexposed interiors are 3/4 inch (19 mm) hardwood plywood. Exterior hanger rails are 4 inches (102 mm) by 3/4 inch (19 mm) hardwood plywood.

G. Tall Cases: Top panels in tall cases with exposed interiors are 1 inch (25 mm) hardwood plywood; tall cases with unexposed interiors have top panels of 1 inch (25 mm) plywood. Bottom panels in tall cases with exposed interiors are 3/4 inch (19 mm) hardwood plywood; and unexposed interiors have 3/4 inch (19 mm) plywood. Interiors, whether exposed or unexposed, are stain color matched to the exterior finish. Adjustable shelves are 1 inch (25 mm) thick hardwood plywood if exposed; 1 inch (25 mm) plywood if unexposed. Shelves are edged with 1/8 inch (3 mm) solid hardwood edging. Backs in tall cases with exposed interiors and exposed exteriors, are 1/4 inch (6 mm) hardwood plywood. Tall cases with unexposed interior or exterior backs have 1/4 inch (6 mm) hardboard melamine color stain matched to the interior. End panels in tall cases with exposed end panels have 3/4 inch (19 mm) hardwood plywood. End panels in cases with unexposed end panels have 3/4 inch (19 mm) plywood. All exposed edges of hardwood plywood components and plywood components are edged with 1/8 inch (3mm) solid hardwood edging. Tall cases have two exterior hardwood plywood cross rails, 4 inches by 3/4 inch (102 mm x 19 mm). Tall cases are rigidly constructed, integral units with the strongest, most advanced joinery methods utilized of bored, doweled, dadoed, glued and screwed construction. Each case is completely enclosed without the use of common partitions and has flush construction with overlapping doors to provide a dust resistant interior. The top panel is bored, doweled and glued into end panels; and the bottom panel is bored, doweled and glued into end panels and glued and screwed to the back. Additional back cross rails are provided as required. Backs are recessed and encapsulated into dadoed end panels and screwed to the top and bottom tall case members. An enclosed toe space 2-1/4 inch by 4 inches (57 mm by 102 mm) is provided with toe rail securely bored, doweled and glued to end panels and bottom panel. Adjustable shelves shall be be 1 inch (25mm) finished plywood and are supported on heavy-duty laboratory grade, twin pin plastic shelf clips, which fit into two rows of holes drilled 1-1/4 inches (32 mm) on centers in the end panels, for maximum shelf adjustability.

H. Drawers: Front is 13/16 inch (20.6 mm) thick hardwood lumber. Drawer faces are screwed to the

face of a full drawer box. Drawer box front, sides and back are 1/2 inch (12 mm), 9-ply laminated hardwood plywood, FSC PURE and CARB Phase 1 compliant. Drawer bottom is 1/4 inch (6 mm) thick hardboard with wood grained melamine face. All four corners of the drawer are dovetailed and glued. The top edges of drawer box are radiused. Drawer bottom is let in on four sides, and securely glued underneath with a continuous bead of glue around the perimeter of the drawer bottom. In cabinets 24 inches or less in width, drawers have one pull. In cabinets over 24 inches wide, drawers have two pulls.

I. Hinged Doors:

1. All Doors have 3/4” inch x 1-1/2” solid lumber stiles and rails with a squared back edge and slight radius to the front edges framing a particleboard core with vertical grain wood veneer face and back.

2. Hinged solid doors 48 inches (1219 mm) or less in height, 3/4 inch (19 mm) thick and overlap the opening on all sides. Doors have one pull. Door has two heavy duty, institutional type, and 5-knuckle hinges. Doors are secured by a friction roller catch and a metal strike plate.

3. Hinged solid doors, over 48 inches (1219 mm) in height, are 3/4 inch (19 mm) thick and overlap the opening on all sides. Single doors and right door of double doors have a latching handle. A three point latching system provides single doors and right door of double doors positive engagements at the top and bottom of the door with tapered aluminum rods, which engage plastic, strike plates and pull the door snug. The rods are 5/16-inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which engages the side of the case, or latches behind the left door on cases with double doors and securely hold the door shut. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Doors have four hinges. On double doors left door is additionally secured with two friction roller catches with metal strike plates.

4. Hinged glazed doors, 48 inches (1219 mm) or less in height, have a solid wood frame 1 1/16 inches (27 mm) by 3 inches (76 mm) with glass panel. Doors overlap opening 1/4 inch (6 mm) on all sides. The frame joints are bored, doweled and glued. The balance of the door is glass. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Doors have one pull, two hinges and are secured by friction roller catches with metal strike plate.

    a. Glass is tempered safety glass is specially heat-treated glass, 1/4 inch (6 mm) thick with a minimum of 88 percent clarity.

J. Sliding Doors:

1. All doors to be fully framed on all four sides with solid hardwood lumber 1 1/8” wide framing a particleboard core and vertical grain wood veneer face and back with crossbands.

2. Sliding solid doors are 13/16 inch (20.6 mm) thick with squared edges and operate in an overhead aluminum sliding door track assembly with adjustable nylon roller hangers. Doors are secured at the bottom of the cabinet with two plastic guides per door that operate in recessed, channels. Each door has one recessed pull with finger grip. Pull is located on outside edge of the door face. Lock is furnished when specified.

3. Sliding glazed doors, 48 inches (1219 mm) or less in height, have a 1 1/16 inches (27 mm) by 3 inches (76 mm), solid wood frame with 1/8 inch (3 mm) thick DSB glass. Door frames have joints bored, doweled and glued. The balance of the door is glass. Doors operate in an overhead aluminum sliding door track assembly with adjustable nylon roller hangers. Doors are secured at the bottom of the cabinet with two plastic guides per door, which operate in

recessed channels. Each door has one pull recessed nickel-plated metal pull with finger grip. Pull is located on outside edge of the door face. Lock is furnished when specified.

a. Glass is tempered safety glass is specially heat-treated glass, 1/4 inch (6 mm) thick with a minimum of 88 percent clarity.

4. Sliding glass doors are 1/4 inch (6 mm) thick tempered safety glass. Doors have polished vertical edges and swiped horizontal edges. Doors operate in sliding aluminum door track assembly, which has an aluminum track at the bottom, and an aluminum channel mounted at the top of the cabinet. The glass rests in aluminum shoes with nylon rollers. The top swiped edge of the glass is fitted with plastic glide clips to assure smooth movement in the channel. Each door has one two-piece recessed round pull. Pull is located on outside edge of the door face. Lock is furnished when specified.

K. Tables: Open Frame Table exterior rails are 4-13/16 inches (122 mm) by 13/16 inch (21 mm), solid hardwood lumber. Interior rails are a minimum of 3/4 inch (19 mm) hardwood plywood. Compartment bottoms are 1/4 inch (6 mm) plywood. Legs are 2 1/4 inches (57 mm) square solid hardwood; legs are not laid up. Leg stretchers, when specified, are 2-1/8 inches (54 mm) by 1 inch (25 mm) thick, solid hardwood Openings are routed in the one-piece rail when drawers or compartments are required. A minimum of two interior cross rails are doweled and glued into exterior rails. Compartment bottoms are let into dadoed grooves in cross rails and the front and back rails, then glued on all four edges. Exterior rails are grooved to receive 3/8 inch (9 mm)flanges on the 13 gauge steel corner stabilizing bracket. Legs are secured to the stabilizing bracket with a 5/16 inch (8 mm) threaded hanger bolt, machine screwed into the solid leg a depth of at least two inches. The stabilizing bracket is attached to the leg bolt by a 5/16”locking nut with serrated flange. Tightening the locking nut on the bolt, draws the stabilizing bracket flanges against the solid hardwood rail, and clamps them against the solid hardwood leg. The stabilizing bracket is further secured to the solid hardwood rails by four (4) Euro screws. Legs have molded black polyethylene, closed bottom, leg shoes. Exterior rails are also grooved to accept Z- clips for attaching the top.

L. Book Shelving: Book shelving top panels are 3/4 inch (19 mm) plywood with a 2-1/2 inch (63 mm) high front fascia of solid hardwood. Bottom panels in cases with exposed interiors are 1 inch (25 mm) plywood. Adjustable shelves in are 1 inch (25 mm) plywood, with solid hardwood edge band on front and back edges. Backs are 1/4 inch (6 mm) plywood. End panels are 1 inch (25 mm) plywood. Exposed edges of end panels, dividers and shelves are edged with 1/4 inch (6 mm) solid wood. Intermediate panels are 1 inch (2 5mm) hardwood plywood. Book shelving is rigidly constructed with full top and bottom frames bolted to end and intermediate panels. Back panels are encapsulated in grooves in end panels and top panel. Book shelf units have adjustable shelves supported by heavy duty chrome plated steel pins recessed in shelf, 1-1/4 inch (32 mm) o.c.

2.05 FINISHES

A. Wood Cabinets: Exterior and interior surfaces of cabinets receive the full finishing process consisting of baked on: specified NGR stain, two coats of protective moisture resistant sealer and two applications of a topcoat of clear catalyzed chemical resistant conversion varnish.

1. Interior Surfaces: The unexposed interior surfaces of cupboards, wall cases, upper cases, and tall cases must match exterior color and receive stain (color coat), a protective coat of moisture resistant sealer, and two applications of a clear, catalyzed, chemical resistant conversion varnish topcoat.

2. Other Surfaces: Unexposed surfaces such as unexposed end panels, unexposed backs, drawer sides and drawer bottoms are processed through standard finishing steps and receive a baked on protective coat of moisture resistant sealer, baked on clear catalyzed chemical resistant conversion varnish, but no stain (color coat).

3. Finish shall comply with SEFA-8 resistance standard acceptable levels for casework surfaces. An independent 3rd party testing facility's written certification must be provided to establish that final finish has no more than three, SEFA-8 "Level 3" conditions.

4. Any deviations from the specified finishing procedures will be considered defective Work and rejected by the Architect.

2.06 CABINET HARDWARE

A. Provide laboratory casework manufacturer's standard finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Lock GL-1 is ratchet type glass door lock, with a disc tumbler mechanism and a polished nickel plate finish. The ratchet bar adjusts from 1 inch (25 mm) to 3 3/8 inches (86 mm). Two keys are provided; master keying is not available. Locks are furnished only when specified.

C. Friction roller catch is zinc plated steel catch with a spring cushioned; polyethylene roller, and a metal strike plate. Screw mounted catches and strike plate have slotted holes for adjustability.

D. Sliding door track assembly DT-1 has an overhead aluminum track and adjustable, nylon roller hangers. The lipped edge of the upper aluminum track prevents rollers from jumping track. Two hard plastic guides are mounted on the bottom interior of the door and operate in recessed channels.

E. Sliding glass door track assembly GT-1 has an aluminum bottom track, and an aluminum channel mounted at the top of the cabinet. The glass rests in aluminum shoes with nylon rollers, which operate in the bottom track. The top swiped edge of the glass is fitted with plastic glide clips to assure smooth movement in the channel.

F. Shelf clips are made from clear polycarbonate and are laboratory standard grade. Clips have double, 3/16 inch (5 mm) diameter pins and are equipped with shelf lock hold down tabs for 3/4 inch (18 mm) or 1 inch (25 mm) thick shelves.

G. Sliding door lock shall be 5-disc tumbler mechanism with a dull chrome plated face. Tumblers and keys are brass, while plug and cylinder are die cast steel. Pushing in on the lock while turning the key, engages a lock bolt into the strike plate; a turn of the key, unlocks the bolt. There are 200 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match.

H. Leg shoes are closed-bottom style, 2 1/4 inches (57 mm) square, and molded of 1/8 inch (3 mm) black polyethylene.

2.07 COUNTER TOPS

A. Rhearesin is 1 inch (25 mm) thick, molded from a modified epoxy resin. Exposed edges and corners are radiused, and a drip groove is provided under surface in areas where sinks are installed. Backsplash is 4 inches (102 mm) high and unless otherwise noted shall be provided at all counter top locations.

1. Color: Black.

2.08 ACCESSORIES

A. Burette Rods: Unless otherwise indicated shall be 3/4" diameter, anodized aluminum x 36 inches long. Horizontal crossbar shall be 3/4" diameter x 39” long and include two aluminum clamps. Rods are furnished with a tapered aluminum adapter to fit rod socket.

B. Clamps: 1 inch (25 mm) square aluminum stock, with two, 3/4 inch (19 mm) diameter openings, at right angles to each other, bored through sides. Openings are for upright rods and crossbars, or Greenlaw Arms.

C. Rod Sockets: Flush Plate type, machined from a solid aluminum rod. Sockets are countersunk into the top and are held in place by a heavy aluminum lock nut and washer.

D. Plastic Tote Tray.

E. Pegboards: Clear acrylic, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.

2.09 SERVICE FIXTURES

A. Electrical Components, Devices, and Accessories shall be labeled to comply with NFPA 70, Article 100 and marked for its intended use.

B. Electrical Fixtures are 3-wire grounded, 20 A, 125V AC, with stainless steel cover plates and cadmium-plated steel boxes. Pedestal boxes are black, cast aluminum with conduit nipples and lock nuts. When specified, G.F.C.I., ground fault circuit interrupter fixtures are available. G.F.C.I. fixtures are 20 A, 125V AC, with black nylon faceplate.

1. Receptacles: Comply with NEMA WD 1, NEMA WD 6, FS W-C-596, and UL 498. Duplex type, Configuration 5 20R.

C. Epoxy Resin Sinks: Drop-in style, non-glaring black, and specially modified epoxy resins, molded in one solid piece with nominal wall thickness of 1/2" for optimum physical and chemical resistance. Inside corners are coved to 1-1/2” radius and the bottom is dished to the outlet. Sinks shall be installed with appropriate supports and the joint between top and sink shall be joined with lab grade silicone. Outlets are polypropylene with 1 1/2 inch (38 mm) NPS threads.

D. Gas, Air and Vacuum Cocks: Ground key cocks, made from high grade, brass forgings, have integral ten serration, non-slip hose end. Wing or knob handle has color-coded index, is one-piece construction, precision ground, and lapped to fit cock chamber. Handle operates with a 1/4 turn, and is spring-loaded for constant pressure and automatic take up. Provide needlepoint valves for high pressures and oxygen service where scheduled.

E. Service Fixtures: Heavy-duty construction for water, gas, steam, or other services and specifically designed for laboratory use. Faucets have serrated hose nozzles, unless specified otherwise. Goosenecks are rigid. Polished chrome plated brass body and tubular spout with metal handles and Low Lead Content (0.25% max.) with color coded index. Goosenecks are rigid with serrated hose nozzles, unless specified otherwise. Fixture outlets are tapped 3/8-inch (10 mm) I.P.S. for aerators, integral vacuum breakers, hose connections, or other accessories. All fixtures shall be as manufactured by T&S Brass and Bronze Works, Inc. or approved equal; Model No. BL-5704-08, BL-5704-08WH4, BL-6000-02 and/or BL-6005-02 – Coordinate with drawings for detailed descriptions.

F. Vacuum Breakers: Vacuum Breakers are brass with polished chrome plating, the screw-in type with stainless steel working parts, consists of a brass body construction with chrome plating with Low Lead Content (0.25% Max), dual check valves, stainless steel working parts, and durable rubber diaphragm and discs. The vacuum breaker is for hot or cold faucet and has a primary valve with a soft disc that seat against the mating part. Breaker is tapped 3/8-inch (10 mm) N.P.T. Vacuum breaker is not intended for constant high pressures. Vacuum breakers shall be furnished where scheduled.

2.10 FUME HOODS

A. Hoods shall be airfoil design and steel frame construction. The design shall provide for safe efficient removal of all fumes, both heavy and light, with the least amount of turbulence as the air enters the hood. Standard airfoil bench superstructures are tested in accordance with the current ASHRAE Test Procedure and comply with the American Conference of Governmental Industrial Hygienists performance recommendations.

B. Materials:

1. Metal is prime furniture steel, free of scales, buckles, or other defects, ASTM A366.

2. Stainless Steel is 304 or 316 type, as noted, commercial grade. No.4 finish, ASTM A167.

3. Safety Glass is 7/32 inch (6 mm) laminated; conforming to ANSI Z97.1 for impact, and to CPSC 16 CFR 1201 for Category II Safety Glazing.

4. PVC is black in color and extruded.

5. Hood Liner is white chemical resistant, fiberglass reinforced thermoset resin sheet.

C. Construction:

1. Hood superstructures have a double wall construction consisting of an outer shell of sheet metal and an inner liner of corrosion resistant material as indicated. Attachment of interior lining material to the steel-framing members is made with non-metallic fasteners. The double wall shall house and conceal steel framing members, attaching brackets and remote operating service fixture valves. The exterior side panels of the superstructure are constructed of 18 gage steel and are removable for access into the interior housing. Access may also be gained through removable panels in the interior liner.

2. Each superstructure shall have an internal baffle system of the same material as the interior lining. This baffle system shall provide for safe efficient removal of fumes when the superstructure is connected to a properly installed exhaust system. A manual adjustment is provided on the upper part of the baffle to allow the operator to set the hood for heavy or light fumes. All baffles are removable for cleaning. Unless specified for use in a variable air volume (VAV) system, the superstructures shall be provided with an air bypass system feature unless; a thin wall or demo hood is specified. The bypass, located at the upper front interior of the hood, shall open as the sash is lowered, providing for a relatively constant exhaust volume of the superstructure. The upper front exterior panel of the superstructure shall be furnished with bypass louvers. These louvers provide for proper operation of bypass when the top of superstructure is closed off to the ceiling.

3. A two tube, T-8 ballast, with rapid start, vapor sealed fluorescent light fixture of maximum length shall be provided on each superstructure. Each fixture shall include two soft white fluorescent tubes. Light fixtures are changed from the top front of the superstructure.

4. Exhaust outlets shall be round, 18 gage stainless steel. Hoods with stainless steel interior lining shall have 18 gage stainless steel exhaust collars welded in place. (Blower and ducts shall be furnished and installed by Mechanical Contractor.)

5. Hoods shall have a full view, vertical rising, laminated safety glass sash framed with a solid black PVC edging, unless otherwise noted. The sash shall not require the use of a center mullion. Sash guides shall be extruded, black PVC. The sash shall be counterbalanced with a single weight located in the center rear of the superstructure. Two 18 inch (3 mm) diameter stainless steel cables connect the sash to the weight. The use of two cables acts as a safety

mechanism keeping the sash from falling in the event one cable would fail. The cables ride on 2 inches (51 mm) diameter nylon ball bearing pulleys. The cable/pulley assembly shall have an adjustment located on the top of the superstructure for proper alignment of the sash.

6. A lower stainless steel airfoil shall act as the sash stop. In addition, the airfoil shall provide a 1 inch (25 mm) space between the bottom of the sash, in the closed position, and the work surface. This 1 inch (25 mm) space shall provide for a continuous sweep of fumes from the work surface.

7. Fume hoods shall include a painted vertical sheet metal closure from top of hood to underside of ceiling system to conceal all HVAC ducts and connections.

D. Hood Types:

1. Barrier Free Hoods (ADA): Shall have an 18-gage, epoxy coated steel, vertical sash with viewing panel. The sash is glazed with tempered safety glass and has a single counterweight. The vertical sash shall ride in PVC sash guides. A stainless steel containment trough incorporates the lower airfoil. The airfoil is hinged for access to clean the trough. The hood has an interior baffle. All other features are as specified under "Construction". These hoods are UL 1805 classified and meet SEFA 1 - 2002 standards.

2. Bypass Airfoil Hoods: Bypass feature provides relatively constant velocity of air through the face of the hood, regardless of the sash position as described in the above specifications. All other features are as specified under "Construction". These hoods are UL 1805 classified and meet SEFA 1 - 2002 Standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

1. Walls and openings are plumb, straight and square.

2. Concrete floors level within 1/8 inch level per 10 foot) run, non-accumulative, when tested with a straight edge in any one direction.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 COORDINATION

A. Laboratory equipment contractor shall furnish equipment to the building, setting in place, leveling and scribing to walls and floors. Furnish plumbing and electrical fixtures, including nipples and lock nuts needed to secure each fixture to the equipment.

B. Coordination with mechanical contractor who shall furnish, install and connect drain lines, service piping, vents, re-vents, in-line vacuum breakers, special plumbing fixtures, traps and tailpieces. Work to be completed through, under or along backs of working surfaces as required and complete final connection of services. Assemble, install and make final connections of service fixtures furnished by casework contractor, including service fixtures in fume hoods. Furnish, install and connect fume hood blowers, motors and all related ductwork. Furnish, install and connect service piping within fume hoods, including final connection.

C. Coordination with electrical contractor who shall furnish, install and connect electrical service lines,

wire and conduit within the equipment, including reagent racks and fume hoods. Work to be completed through, under or along backs of working surfaces as required and complete final connection of services. Install and make final connections of electrical fixtures provided by casework installer, including electrical fixtures in fume hoods.

3.03 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.04 INSTALLATION

A. Install casework in accordance with manufacturer's instructions.

1. Installation of casework shall be plumb, level, true and straight, with no distortions.

2. Use concealed shims as required.

3. Where laboratory casework or equipment butts against other finished work, scribe and cut for an accurate fit.

4. Lubricate operating hardware as recommended by the manufacturer.

B. Install countertop and edge surfaces in one plane with flush hairline seams. Locate seams where shown on Shop Drawings.

1. Provide required holes and cutouts for service fittings as shown on Shop Drawings.

2. Seal unfinished edges and cutouts in plastic-laminate countertops.

3. Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

4. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Coordination with Mechanical, Plumbing and Electrical Contractors: Coordinate work of this Section with work of other Sections including but not limited to:

1. Water and laboratory gas service fittings, piping, electrical devices, and wiring.

2. Installation of fittings according to Shop Drawings and manufacturer's written instructions.

3. Setting bases and flanges of sink and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material.

4. Anchorage of fittings, piping, and conduit to laboratory casework, unless otherwise indicated.

3.05 PROTECTION

A. Cover installed casework and equipment with 4-mil polyethylene.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. A qualified manufacturer representative shall demonstrate operation and maintenance procedures of the installed casework and equipment to the Owners personnel.

E. Remove all debris, dirt, rubbish, and excess material accumulated as a result of the installation of this equipment and leave casework clean and orderly.

END OF SECTION

DIVISION 12 – FURNISHINGS

SECTION 123213 – WOOD CASEWORK AND CLASSROOM WARDROBE UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS and SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 096519 – Resilient Flooring
4. Section 220500 – Basic Materials and Methods
5. Section 230500 – Basic Materials and Methods
6. Section 260500 – Basic Materials and Methods

B. This section includes, but is not limited to:

1. Student wardrobe units and Teacher's storage units.
2. Countertop assemblies with backsplash and casework.
3. All filler panels, frame units, scribe strips, wall strips, accessories, etc.
4. Electrical fixtures and accessories
5. Utility-space closure panels between base cabinets and at end exposed ends of utility spaces
6. Utility-space framing at backs of base cabinets and between backs of base cabinets
7. Related equipment

1.02 QUALIFICATIONS

A. All wood casework covered by this specification and accompanying drawings shall be manufactured or furnished by one manufacturer and supplied under his direction to eliminate any divided responsibility.

1.03 QUALITY ASSURANCE

A. Products of Campbell Rhea are specified as a basis of design, quality, and layout. The specifications and drawings define and show the material or manufacturer is specified, it is not the intent to discriminate against any product of another manufacturer. However, it is the intent of this specification to provide for the Owner a quality, functional installation of wood casework, and to exclude inadequate or inferior wood casework.

B. Manufacturer Qualifications: Not less than five (5) years experience in the actual production of specified products.

C. Installer Qualifications: Firm with min. five (5) years experience in installation or application of systems similar in complexity to those required for this project.

D. Mock-Up: Provide a mock-up for evaluation of fabrication techniques and application workmanship.

1. Installation in area designated by Architect.
2. Do not proceed with remaining work until installation is approved by Architect.

1.04 WORK BY CASEWORK MANUFACTURER/CONTRACTOR

A. Furnishing, delivering to the building, uncrating, setting in place, leveling, and anchoring all casework and equipment listed in the specifications or equipment schedule and/or shown on the drawings.

B. Furnishing plumbing fixtures (faucets, gas cocks/turrets, side mount eyewashes, etc.) and fittings as defined in the specifications and/or as shown on the drawings, complete with tank nipples and lock nuts for mounting fixtures and fitting on tops or curbs. Installation will be by other respective trades as part of their final connections.

C. Furnishing electrical service fixtures directly attached to the casework or equipment as defined in the specifications, equipment list, and/or shown on the drawings. Fixtures supplied only, not attached or assembled. Installation will be by other respective trades as part of their final connections.

D. Furnishing and installing sink bowls and cup sinks, complete with required overflows, plugs, strainers and tail pieces as defined in the specifications, equipment list, and/or shown on the drawings. Final connections of drain piping and venting will be by other respective trades.

E. Furnishing and installing filler panels and scribes as required for finished installation.

F. Removal of all debris, dirt, and rubbish accumulated as a result of installation of this equipment, leaving premises broom clean and orderly.

G. Store products in manufacturers unopened packaging until project conditions are ready for installation.

H. Factory cut out for all sinks, core drilling for all services and grommets in epoxy resin tops.

1.05 WORK BY OTHERS

A. Furnishing, installing, and connecting of all service lines, drain lines, piping, and conduits, in service turrets or tunnels through, under, or along the backs of working surfaces, and in reagent racks above countertops as required by specifications and/or drawings.

B. Furnishing, installing, and connecting all vents, revents, steam fittings, and special plumbing fixtures or piping to meet local codes, even though not specifically called for in the specifications and/or shown on the drawings.

C. Furnishing and installing of all rigid or flexible conduit, wire, pulling of wire, fittings, and special electrical equipment and accessories, including boxes, receptacles, and flush plates sent loose. Included are those in box curbs or tops, which are not installed at equipment contractor's plant due to inconvenience of shipping. All shall be in accordance with local codes even though not specifically called for in the specifications and/or shown on the drawings.

D. Providing all framing and reinforcements of walls, floors, and ceilings necessary to adequately support the equipment and all bucks and plaster grounds required for proper installation of equipment.

E. Unless otherwise noted on drawings, all perimeter rubber cove base.

1.06 SUBMITTALS

A. Submit the following in accordance with General Conditions of contract specifications and Specification Section 013300 – Submittal Procedures.

B. Manufacturers product data sheets on each product to be used, including,

1. Test reports certifying that the casework finish complies with SEFA-8 standards for chemical and physical resistance performance requirements.
2. Performance test reports from an independent testing lab on each specified top material.
3. Preparation instructions and recommendations
4. Storage and handling requirements and recommendations
5. Installation instructions.
6. Operation and maintenance data

C. Shop Drawings: Include plans, elevations, sections, details and attachments to other work.

1. Indicate locations of blocking and reinforcements required for installing wood casework.
2. Indicate locations and types of service fittings, together with associated service supply connection required.
3. Include details of utility spaces.
4. Include indicators of exposed conduits, if required, for service fittings.
5. Indicate locations of and clearances from adjacent walls, doors, windows and other building components, and other wood casework.
6. Include coordinated dimensions for equipment specified in other Sections.
7. Include dimensioned utility rough-in plans.
8. Include countertops showing sizes, shapes, edge and backsplash profiles, cutouts for plumbing fixtures and methods of joining.

D. Selection Samples: Include plans, elevations, sections, details and attachments to other work.

1. Samples for initial selection purposes of manufacturers color charts showing the full range of colors, textures and patters for each type of material included in this specification.

2. Samples for verification purposes must be based on the following specifications and not a “manufacturers standard” product. Upon request of the architect, samples must be submitted within thirty (30)-days and may be held until project completion. Samples that may be required are as follows:

a. Full size base cabinet with door and drawers – 24” x 22”w x 36”h.
b. Full size upper cabinet with solid hinged door – 24” x 12”d x 30”h.
c. 12”x12” countertop

E. Certificate of Origin: Manufacturer must supply with first submittal, an example of their Certificate of Origin declaring casework is wholly manufactured and assembled in the United States.

1.07 MAINTENANCE AND OPERATING INSTRUCTIONS

A. The Contractor shall include in his/her bid the cost of providing a technically qualified representative for a period of one (1) day to thoroughly instruct the Owner's personnel in correct procedures of operating and maintaining this contract.

1.08 PROJECT CONDITIONS

A. For delivery and installation of casework and equipment, building conditions shall comply with the following AWI Standard 1700-G-3 and 1700-G-4:

1. Flooring required to be placed under casework and equipment installed.
2. Wood or metal blocking (wall grounds) installed within partitions to allow for immediate installation upon delivery.
3. Overhead mechanical, electrical and plumbing rough-in work is complete.

4. Wet operations complete prior to delivery.
5. Ceiling grids (with or without ceiling tiles), overhead soffits, ductwork and lighting installed.

1.09 WARRANTY

A. Casework Manufacturer Warranty: 3 years from date of delivery. Warranty is for the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly investigate and address said deficiencies.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum SEFA 8 standards as certified by independent third party testing laboratory.
3. Within the warranty period, the manufacturer shall repair or replace defective casework.

B. Casework manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods. Casework manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Casework manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of casework; and, shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of their products.

1. The warranty with respect to products from another company sold by the casework manufacturer is limited to the warranty extended by that other company, but in no case be less than the duration stated in Specification Section 017000.

C. Casework manufacturer shall provide, with close-out documents, a Certificate of Warranty for products provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Specification: CampbellRhea, which is located at: 1865 N. Market St.; Paris, TN 38242; Tel: 731-642-4251; Fax: 731-642-4262; Web: www.campbellrhea.com.

1. Acceptable alternate manufacturers:

a. Sheldon Laboratory Systems
b. Thermo/Fisher-Hamilton
c. Or as approved by Architect and/or Owner

B. Product Designations: Drawings indicate sizes and configurations of wood casework by referencing designated manufacturer's catalog numbers. Other manufacturers' wood casework of similar sizes, similar door and drawer configurations, and complying with the Specifications, including certification to SEFA-8 standards for construction and chemical resistance, may be approved for substitution.

2.02 CONSTRUCTION

A. Solid lumber and wood veneer on plywood core.

B. Cabinet Finish, Interiors and Exteriors Match Finished:

1. Wood Species: Oak.
2. Finish: As selected by the Architect. Interior finish and color to match exterior.

C. Drawer Styles:

1. Signature Drawer Styling: Drawer fronts are 13/16 inch (20.6 mm) thick solid lumber and have a squared back edge and slight radius to the front edges. Drawers have horizontal grain.

D. Door Styles:

1. Signature Door Styling: Doors have 3/4” inch x 1-1/2” solid lumber stiles and rails with a squared back edge and slight radius to the front edges framing a particleboard core with vertical grain wood veneer face and back.

E. Door and Drawer Hardware Style:

1. Drawer and door pulls: AL-3: Extruded aluminum bow rod design.

2. Hinges: Heavy-duty, institutional type, 5-knuckle hospital tipped, made from 0.083 inch (2 mm) thick chrome plated steel. Hinge is semi-concealed, 2 3/4 inches (70mm) high and has off-set wings; each wing has 5 screw holes for the door leaf and 4 screw holes for the case leaf, two of which are slotted for adjustability. Hinges are attached with Euro screws.

3. Latching Handle: Latching handle CP LH-1 is chrome plated, 4 1/4 inches (108 mm) long and streamline in design. Handle operates with 1/4 turn. Double door cases have latching handles on the right door and dummy handles on the left door. A three point latching system provides a positive engagement at the top and bottom of the door with tapered aluminum rods, which pull the door snug when they engage plastic strike plates. The rods are 5/16 inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which engages the side of the case, or latches behind the left door on cases with double doors.

4. Locking Handle: Chrome plated locking handle is a latching handle with a lock mechanism incorporated into the handle head. On double door cases, the left door has a dummy handle, and the right door has the locking handle. Lock is laboratory grade with a 5-disc tumbler mechanism with a brushed chrome face. Tumblers and keys are brass, while the plug and cylinder is die cast zinc alloy. There are 500 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match.

5. Locks; Removable core standards: Lock CP SL-1 is laboratory grade, cylinder cam lock, with a 5-disc tumbler mechanism with a chrome plated face. Tumblers and keys are brass, while plug and cylinder is die cast zinc alloy. A 180-degree turn of the key moves the lock cam into, or out of, a slot cut to receive it. There are 500 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match. Lock CP SL-1 is equipped with a removable core, keying control. With the use of a control key, the key core of the lock assembly can be removed and a new key core inserted, changing the entire locking system in a matter of minutes. Key cores can be held out of the lock assembly until the project is completed, removing the security risk of lost or stolen keys during installation and construction. Casework manufacturer shall provide control keys and replacement cores. Locks shall be furnished on all doors, drawers, etc. unless otherwise noted. Individual rooms shall be keyed alike, each room shall be keyed differently.

6. Drawer Slides: Full Extension: Drawer slides are zinc plated, cold rolled steel, heavy-duty with a 150 lb. load capacity. They are equipped with steel ball bearings for smooth effortless operation. Slides have automatic positive stop to prevent drawer's accidental removal, but allow for quick removal without tools.

7. File Drawer Slides: FD-1: Zinc plated, cold rolled steel, heavy-duty, side mounted, and have a 125 lbs (56.25 kg) load capacity. They are equipped with heavy-duty, ball bearing nylon rollers for smooth effortless operation. Slides are full extension with a positive stop, and a trigger finger release.

2.03 MATERIALS

A. Oak Lumber: Grade FAS or better, air-dried and kiln dried to 6 percent moisture content, then tempered to 7 to 8 percent prior to fabrication. Lumber exposed to view, is free of stains, splits, shakes, season checks and other similar defects. Other hardwoods are grade FAS or better, air dried to 6 percent moisture content, then tempered to 7 to 8 percent prior to fabrication. Other hardwoods are used in semi-exposed, or unexposed, areas and comply with NHLA grading for FAS or better lumber.

B. Oak Plywood: Plywood is rotary cut, select grade A-1 cross-banded, and has a veneer core. The 1 inch (25 mm) or 3/4 inch (19 mm) plywood is a minimum of 7-ply, 1/2 inch (12 mm) is a minimum of 5 ply, 1/4 inch (6 mm) is minimum of 3 ply, and 3/32 inch (2.4 mm) is 3-ply. Other hardwood plywood is sound grade, has a solid core and is suitable for semi-exposed or unexposed areas. All plywood shall be CARB Phase 1 compliant.

C. Hardboard used in drawer bottoms and unexposed backs, consists of super-refined wood fibers and chips, highly compressed into a hard, dense, 1/4 inch (6 mm) thick, homogeneous sheet, faced with wood grain pattern melamine on the exposed face. Physical properties: Average MOR is 5,000 lbs/sq inches (3.5 kgf/sq mm); density is 48 lbs/cu ft (0.6 kg/cu m); and MOE of 500,000 psi (350 kgf/sq mm). All hardboard shall be CARB Phase 1 compliant.

2.04 FABRICATION

A. Units and configurations designated for accessibility by users shall comply with ATBCB ADAAG (ADA standards).

B. Design, material and construction of casework, shelving and tables shall comply with SEFA 8 performance and resistance standards.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for its intended use.

D. Base Cabinets: Base cabinets shall have a 2 1/4 inches by 1 inch, solid hardwood horizontal front top frame member and 2 1/8 inches by 1 inch, solid hardwood horizontal rear and side top frame members. Front intermediate rails are 3/4 inch by 2 1/2 inches solid wood. Back intermediate rails are furnished only when drawer separators are specified. Exposed exterior backs are 3/4 inch (19 mm) plywood. Cabinets with exposed interiors but unexposed exteriors have 1/4 inch plywood backs. Cabinets with unexposed interiors and exteriors have 1/4 inch thick hardboard with wood grained melamine face backs. Exposed end panels are 3/4 inch (19 mm) plywood. Unexposed end panels are 3/4 inch hardwood plywood. End panels with unexposed interior and unexposed exterior are 3/4 inch (19 mm) hardwood plywood. Bottom, shelves, and dividers in cabinets with exposed interiors are 3/4 inch plywood; with unexposed interiors is 3/4 inch hardwood plywood. All intermediate cabinet shelves shall be 1 inch (25mm) finished plywood. Exposed edges of front top horizontal frame and intermediate rail members; end panels, bottom, shelves, and dividers are edged with 1/8 inch, solid wood. Drawer separators, furnished only when specified, are 1/4 inch thick hardboard with wood grained melamine face.

E. Cabinet Construction: Cabinet construction shall have bored, doweled, dadoed, glued and screwed construction. Cabinets are enclosed without the use of common partitions. A full horizontal, mortise, tenon and glued, top frame is bored, doweled, glued, and reinforced with six (6) screws into the

cabinet. Intermediate front rails and bottom rear horizontal parting rails are provided as required. Separators, where specified, are let into routed intermediate rails. Backs are recessed and encapsulated into dadoed end panels then screwed into the top and bottom case members. A standard enclosed toe space, 2-1/4 inches (57 mm) by 4 inches (102 mm) high, is provided, with toe rail bored, doweled and glued to end panels; however, casework cabinets, when in a library assembly such as a circulation desk, will have an enclosed toe space 2-1/4 inches (57 mm) deep by 6 inches (152 mm) high. Shelves are supported on heavy-duty, laboratory grade, twin pin plastic shelf clips, which fit into two double rows of holes drilled 1-1/4 inches (32 mm) on centers, in the case end panels for maximum shelf adjustability.

F. Wall and Upper Cases: Wall and upper cases shall have a 1 inch (25 mm) plywood top and bottom panel. Adjustable shelves are 1 inch (25 mm) finished plywood in cases with exposed interiors and 1 inch (25 mm) hardwood plywood in cases with unexposed interiors. Backs are 1/4 inch (6 mm) finished plywood in cases with exposed interiors and 1/4 inch (6 mm) thick hardboard with melamine face in cases with unexposed interiors. End panels in cabinets with exposed interiors are 3/4 inch (19 mm) finished plywood; end panels in cabinets with unexposed interiors are 3/4 inch (19 mm) hardwood plywood. Exterior hanger rails are 4 inches (102 mm) by 3/4 inch (19 mm) hardwood plywood.

G. Tall Cases: Top panels in tall cases with exposed interiors are 1 inch (25 mm) hardwood plywood; tall cases with unexposed interiors have top panels of 1 inch (25 mm) plywood. Bottom panels in tall cases with exposed interiors are 3/4 inch (19 mm) hardwood plywood; and unexposed interiors have 3/4 inch (19 mm) plywood. Interiors, whether exposed or unexposed, are stain color matched to the exterior finish. Adjustable shelves are 1 inch (25 mm) thick hardwood plywood if exposed; 1 inch (25 mm) plywood if unexposed. Shelves are edged with 1/8 inch (3 mm) solid hardwood edging. Backs in tall cases with exposed interiors and exposed exteriors, are 1/4 inch (6 mm) hardwood plywood. Tall cases with unexposed interior or exterior backs have 1/4 inch (6 mm) hardboard melamine color stain matched to the interior. End panels in tall cases with exposed end panels have 3/4 inch (19 mm) hardwood plywood. End panels in cases with unexposed end panels have 3/4 inch (19 mm) plywood. All exposed edges of hardwood plywood components and plywood components are edged with 1/8 inch (3mm) solid hardwood edging. Tall cases have two exterior hardwood plywood cross rails, 4 inches by 3/4 inch (102 mm x 19 mm). Tall cases are rigidly constructed, integral units with the strongest, most advanced joinery methods utilized of bored, doweled, dadoed, glued and screwed construction. Each case is completely enclosed without the use of common partitions and has flush construction with overlapping doors to provide a dust resistant interior. The top panel is bored, doweled and glued into end panels; and the bottom panel is bored, doweled and glued into end panels and glued and screwed to the back. Additional back cross rails are provided as required. Backs are recessed and encapsulated into dadoed end panels and screwed to the top and bottom tall case members. An enclosed toe space 2-1/4 inch by 4 inches (57 mm by 102 mm) is provided with toe rail securely bored, doweled and glued to end panels and bottom panel. Adjustable shelves shall be be 1 inch (25mm) finished plywood and are supported on heavy-duty laboratory grade, twin pin plastic shelf clips, which fit into two rows of holes drilled 1-1/4 inches (32 mm) on centers in the end panels, for maximum shelf adjustability.

H. Drawers: Front is 13/16 inch (20.6 mm) thick hardwood lumber. Drawer faces are screwed to the face of a full drawer box. Drawer box front, sides and back are 1/2 inch (12 mm), 9-ply laminated hardwood plywood, FSC PURE and CARB Phase 1 compliant. Drawer bottom is 1/4 inch (6 mm) thick hardboard with wood grained melamine face. All four corners of the drawer are dovetailed and glued. The top edges of drawer box are radiused. Drawer bottom is let in on four sides, and securely glued underneath with a continuous bead of glue around the perimeter of the drawer bottom. In cabinets 24 inches or less in width, drawers have one pull. In cabinets over 24 inches wide, drawers have two pulls.

I. Hinged Doors:

1. All Doors have 3/4” inch x 1-1/2” solid lumber stiles and rails with a squared back edge and

slight radius to the front edges framing a particleboard core with vertical grain wood veneer face and back.

2. Hinged solid doors 48 inches (1219 mm) or less in height, 3/4 inch (19 mm) thick and overlap the opening on all sides. Doors have one pull. Door has two heavy duty, institutional type, and 5-knuckle hinges. Doors are secured by a friction roller catch and a metal strike plate.

3. Hinged solid doors, over 48 inches (1219 mm) in height, are 3/4 inch (19 mm) thick and overlap the opening on all sides. Single doors and right door of double doors have a latching handle. A three point latching system provides single doors and right door of double doors positive engagements at the top and bottom of the door with tapered aluminum rods, which engage plastic, strike plates and pull the door snug. The rods are 5/16-inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which engages the side of the case, or latches behind the left door on cases with double doors and securely hold the door shut. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Doors have four hinges. On double doors left door is additionally secured with two friction roller catches with metal strike plates.

4. Hinged glazed doors, 48 inches (1219 mm) or less in height, have a solid wood frame 1 1/16 inches (27 mm) by 3 inches (76 mm) with glass panel. Doors overlap opening 1/4 inch (6 mm) on all sides. The frame joints are bored, doweled and glued. The balance of the door is glass. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Doors have one pull, two hinges and are secured by friction roller catches with metal strike plate.

    a. Glass is tempered safety glass is specially heat-treated glass, 1/4 inch (6 mm) thick with a minimum of 88 percent clarity.

J. Sliding Doors:

1. All doors to be fully framed on all four sides with solid hardwood lumber 1 1/8” wide framing a particleboard core and vertical grain wood veneer face and back with crossbands.

2. Sliding solid doors are 13/16 inch (20.6 mm) thick with squared edges and operate in an overhead aluminum sliding door track assembly with adjustable nylon roller hangers. Doors are secured at the bottom of the cabinet with two plastic guides per door that operate in recessed, channels. Each door has one recessed pull with finger grip. Pull is located on outside edge of the door face. Lock is furnished when specified.

3. Sliding glazed doors, 48 inches (1219 mm) or less in height, have a 1 1/16 inches (27 mm) by 3 inches (76 mm), solid wood frame with 1/8 inch (3 mm) thick DSB glass. Door frames have joints bored, doweled and glued. The balance of the door is glass. Doors operate in an overhead aluminum sliding door track assembly with adjustable nylon roller hangers. Doors are secured at the bottom of the cabinet with two plastic guides per door, which operate in recessed channels. Each door has one pull recessed nickel-plated metal pull with finger grip. Pull is located on outside edge of the door face. Lock is furnished when specified.

    a. Glass is tempered safety glass is specially heat-treated glass, 1/4 inch (6 mm) thick with a minimum of 88 percent clarity.

4. Sliding glass doors are 1/4 inch (6 mm) thick tempered safety glass. Doors have polished vertical edges and swiped horizontal edges. Doors operate in sliding aluminum door track assembly, which has an aluminum track at the bottom, and an aluminum channel mounted at the top of the cabinet. The glass rests in aluminum shoes with nylon rollers. The top swiped edge of the glass is fitted with plastic glide clips to assure smooth movement in the channel.

Each door has one two-piece recessed round pull. Pull is located on outside edge of the door face. Lock is furnished when specified.

K. Book Shelving: Book shelving top panels are 3/4 inch (19 mm) plywood with a 2-1/2 inch (63 mm) high front fascia of solid hardwood. Bottom panels in cases with exposed interiors are 1 inch (25 mm) plywood. Adjustable shelves in are 1 inch (25 mm) plywood, with solid hardwood edge band on front and back edges. Backs are 1/4 inch (6 mm) plywood. End panels are 1 inch (25 mm) plywood. Exposed edges of end panels, dividers and shelves are edged with 1/4 inch (6 mm) solid wood. Intermediate panels are 1 inch (2 5mm) hardwood plywood. Book shelving is rigidly constructed with full top and bottom frames bolted to end and intermediate panels. Back panels are encapsulated in grooves in end panels and top panel. Book shelf units have adjustable shelves supported by heavy duty chrome plated steel pins recessed in shelf, 1-1/4 inch (32 mm) o.c.

2.05 FINISHES

A. Wood Cabinets: Exterior and interior surfaces of cabinets receive the full finishing process consisting of baked on: specified NGR stain, two coats of protective moisture resistant sealer and two applications of a topcoat of clear catalyzed chemical resistant conversion varnish.

1. Interior Surfaces: The unexposed interior surfaces of cupboards, wall cases, upper cases, and tall cases must match exterior color and receive stain (color coat), a protective coat of moisture resistant sealer, and two applications of a clear, catalyzed, chemical resistant conversion varnish topcoat.

2. Other Surfaces: Unexposed surfaces such as unexposed end panels, unexposed backs, drawer sides and drawer bottoms are processed through standard finishing steps and receive a baked on protective coat of moisture resistant sealer, baked on clear catalyzed chemical resistant conversion varnish, but no stain (color coat).

3. Finish shall comply with SEFA-8 resistance standard acceptable levels for casework surfaces. An independent 3rd party testing facility's written certification must be provided to establish that final finish has no more than three, SEFA-8 "Level 3" conditions.

4. Any deviations from the specified finishing procedures will be considered defective Work and rejected by the Architect.

2.06 CABINET HARDWARE

A. Provide wood casework manufacturer's standard finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Lock GL-1 is ratchet type glass door lock, with a disc tumbler mechanism and a polished nickel plate finish. The ratchet bar adjusts from 1 inch (25 mm) to 3 3/8 inches (86 mm). Two keys are provided; master keying is not available. Locks are furnished only when specified.

C. Friction roller catch is zinc plated steel catch with a spring cushioned; polyethylene roller, and a metal strike plate. Screw mounted catches and strike plate have slotted holes for adjustability.

D. Sliding door track assembly DT-1 has an overhead aluminum track and adjustable, nylon roller hangers. The lipped edge of the upper aluminum track prevents rollers from jumping track. Two hard plastic guides are mounted on the bottom interior of the door and operate in recessed channels.

E. Sliding glass door track assembly GT-1 has an aluminum bottom track, and an aluminum channel mounted at the top of the cabinet. The glass rests in aluminum shoes with nylon rollers, which operate in the bottom track. The top swiped edge of the glass is fitted with plastic glide clips to assure smooth movement in the channel.

F. Shelf clips are made from clear polycarbonate and are laboratory standard grade. Clips have double, 3/16 inch (5 mm) diameter pins and are equipped with shelf lock hold down tabs for 3/4 inch (18 mm) or 1 inch (25 mm) thick shelves.

G. Sliding door lock shall be 5-disc tumbler mechanism with a dull chrome plated face. Tumblers and keys are brass, while plug and cylinder are die cast steel. Pushing in on the lock while turning the key, engages a lock bolt into the strike plate; a turn of the key, unlocks the bolt. There are 200 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match.

2.07 COUNTER TOPS

A. Phenolic Resin. 1" thick. Color as selected by Architect.

2.08 ACCESSORIES

A. Plastic Tote Tray.

B. Tack boards on designated unit doors.

2.09 SERVICE FIXTURES

A. Electrical Components, Devices, and Accessories shall be labeled to comply with NFPA 70, Article 100 and marked for its intended use.

B. Electrical Fixtures are 3-wire grounded, 20 A, 125V AC, with stainless steel cover plates and cadmium-plated steel boxes. Pedestal boxes are black, cast aluminum with conduit nipples and lock nuts. When specified, G.F.C.I., ground fault circuit interrupter fixtures are available. G.F.C.I. fixtures are 20 A, 125V AC, with black nylon faceplate.

1. Receptacles: Comply with NEMA WD 1, NEMA WD 6, FS W-C-596, and UL 498. Duplex type, Configuration 5 20R.

C. Sinks: Drop-in sinks by others, unless otherwise noted. Coordinate sink cut-outs with plumbing contractor for factory preparation.

D. Faucets: By others, unless otherwise noted. Coordinate sink cut-outs with plumbing contractor for factory preparation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

1. Walls and openings are plumb, straight and square.

2. Concrete floors level within 1/8 inch level per 10 foot run, non-accumulative, when tested with a straight edge in any one direction.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 COORDINATION

A. Wood casework contractor shall furnish equipment to the building, setting in place, leveling and scribing to walls and floors. Furnish plumbing and electrical fixtures, including nipples and lock nuts needed to secure each fixture to the equipment.

B. Coordination with mechanical contractor who shall furnish, install and connect drain lines, service piping, vents, re-vents, in-line vacuum breakers, special plumbing fixtures, traps and tailpieces. Work to be completed through, under or along backs of working surfaces as required and complete final connection of services. Assemble, install and make final connections of service fixtures furnished by casework contractor, including service fixtures in fume hoods. Furnish, install and connect fume hood blowers, motors and all related ductwork. Furnish, install and connect service piping within fume hoods, including final connection.

C. Coordination with electrical contractor who shall furnish, install and connect electrical service lines, wire and conduit within the equipment, including reagent racks and fume hoods. Work to be completed through, under or along backs of working surfaces as required and complete final connection of services. Install and make final connections of electrical fixtures provided by casework installer, including electrical fixtures in fume hoods.

3.03 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.04 INSTALLATION

A. Install casework in accordance with manufacturer's instructions.

1. Installation of casework shall be plumb, level, true and straight, with no distortions.
2. Use concealed shims as required.
3. Where wood casework butts against other finished work, scribe and cut for an accurate fit.
4. Lubricate operating hardware as recommended by the manufacturer.

B. Install countertop and edge surfaces in one plane with flush hairline seams. Locate seams where shown on Shop Drawings.

1. Provide required holes and cutouts for service fittings as shown on Shop Drawings.
2. Seal unfinished edges and cutouts in plastic-laminate countertops.
3. Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent wood casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
4. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Coordination with Mechanical, Plumbing and Electrical Contractors: Coordinate work of this Section with work of other Sections including but not limited to:

1. Water, piping, electrical devices, and wiring.
2. Installation of fittings according to Shop Drawings and manufacturer's written instructions.
3. Setting bases and flanges of sink and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material.
4. Anchorage of fittings, piping, and conduit to wood casework, unless otherwise indicated.

3.05 PROTECTION

A. Cover installed casework and equipment with 4-mil polyethylene.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. A qualified manufacturer representative shall demonstrate operation and maintenance procedures of the installed casework and equipment to the Owners personnel.

E. Remove all debris, dirt, rubbish, and excess material accumulated as a result of the installation of this equipment and leave casework clean and orderly.

END OF SECTION

DIVISION 12 – FURNISHINGS

SECTION 123216 – MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Related Documents:

1. Drawings and provisions of the contract including General Conditions Supplementary Conditions and Division 01, apply to this section.

B. Section Includes:

1. Furnish and install plastic laminate casework and accessories as shown and listed on drawings and specified herein. Includes all countertops, sink cutouts, splashes, supports, shelving, and filler panels necessary for a complete casework installation.

C. Related Requirements to be Performed by Others:

1. Section 061000 – Rough Carpentry
2. Section 062000 – Finish Carpentry
3. Section 079200 – Joint Sealants
4. Section 096519 – Resilient Tile Flooring

1.02 REFERENCES

A. ANSI-A135: For all hardboard.
B. ANSI-A161.2-1998: For performance of fabricated high-pressure decorative laminate countertops.
C. ANSI-A208.1-2016: For grade M-3 mat-formed wood particleboard.
D. BHMA A156.9: For grade-1 hinge requirements.
E. NEMA 3 LD-2005: For performance requirements of high pressure laminates.
F. AWS: American Woodworking Standards, Edition 2.

1.03 DEFINITIONS

A. Exposed:

1. In casework, surfaces visible when drawers and opaque doors (if any) are closed; behind clear glass doors; bottoms of cabinets 42" or more above finished floor; and tops of cabinets less than 78" above finished floor.

B. Semi-Exposed:

1. In casework, surfaces that become visible when opaque doors are open or drawers are extended; bottoms of cabinets more than 30" or tops of cabinets less than 42" above finished floor.

1.04 SUBMITTALS

A. Shop Drawings:

1. Comply with Section 013300 – Submittal Procedures.

2. Include catalog numbers and detailed written specifications.

3. Submit three sets of shop drawings consisting of:

    a. Finish, hardware, construction options selection sheet.
    b. Small scale floor plan showing casework in relation to the building.
    c. Large scale elevations and plan views.
    d. Cross-sections; service runs; locations of blocking within walls (blocking is done by others); rough-in requirements and, sink centerlines.

4. Manufacturer and/or Contractor verifies all critical building dimensions prior to fabrication.

B. Samples:

1. Submit one set of laminate color brochures or webpage reference from standard laminate manufacturers Wilsonart, Formica, Pionite, and Nevamar.

2. Submit one edge color sample chain.

3. Submit catalog showing construction details, material specifications and hardware specifications of all items used.

C. LEED Submittals (if required):

1. Provide EPP certificates of core for Credit MR 4.1 for casework core having recycled content.

2. Provide FSC certificate for Credit MR 7: for products having chain-of-custody certificate certifying that the wood used in the casework complies with FSC requirements.

3. Provide product data for IEQ 4.4: for casework core being manufactured without the use of urea formaldehyde.

D. Warranty:

1. Provide sample warranty document stating specified terms as referenced in 1.8.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer has a minimum of 10 years of experience of manufacturing architectural casework for similar projects, with a cataloged product line, and can show evidence of long-lasting financial stability.

2. Certified for chain of custody by third party group approved by Forest Stewardship Council (FSC).

B. Unless otherwise indicated, comply with AWI, for grades of interior architectural woodwork, including installation, complies with requirements of grades specified. The manufacturer, upon award of work, shall register the work under this section with AWI Quality Certification Program (800-449-8811).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver casework once painting, and similar requirements have been completed that will not damage casework. This includes ensuring spaces are enclosed and weather tight.

2. All casework shall be blanket wrapped for protection during shipping.

B. Storage and Handling:

1. Casework must be protected from dust, dirt and/or other trades.

2. Countertops are stacked, properly supported and spaced evenly to avoid warping. Large pieces are stacked first on the pallets with shorter pieces stacked on top.

1.07 WARRANTY

A. Provide a Five-Year warranty to the owner against defective material and workmanship.

1. The warranty specifically does not cover any product or hardware, which has been incorrectly installed, including poor climate conditions, exposed to excessive loads or abuse.

2. Non-casework items supplied, but not necessarily manufactured by the casework manufacturer including, but not limited to sinks, fixtures, apparatus, fume hoods, keyboard trays, spray booths, lights, power outlets, and power strips shall be covered under the original manufacturers' warranty.

PART 2– PRODUCTS

2.01 MANUFACTURERS

A. Design is based on use of products as manufactured Case Systems Inc., 2700 James Savage Road, Midland, Michigan 48642 (989) 496-9510 www.casesystems.com and/or approved dealers, and the terminology used may include reference to that manufacturer's proprietary products. Such reference shall be construed only as establishing the quality of materials and workmanship to be used under this section and shall not, in any way, be construed as limiting completion.

2.02 MATERIALS

A. Provide Plastic Laminate Faced Cabinets Manufactured with:

1. Particleboard Core:

a. All particleboard shall be Grade M-3i and shall meet or exceed all requirements as set by ANSI-A208.1-2016.

Modulus of Rupture	2176 psi
Modulus of Elasticity	362600 psi
Internal Bond	73 psi
Linear Expansion	0.40%
Thickness Tolerance	+/- 0.008"
Face Screw Holding	225 pounds Min

2. MR (Moisture Resistant)/FSC Core shall be:

a. Interior-Grade moisture resistant particleboard.
b. Meet or exceed M-3i Grade, according ANSI-A208.1-2016.

3. Low Emitting Core shall be: (For LEED Projects)

    a. ULEF/FSC (No added Urea Formaldehyde) M-2 Particleboard:

        1) For casework core having recycled content.
        2) For casework core being manufactured without the use of urea formaldehyde.
        3) For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.

    b. ULEF/FSC (No added Urea Formaldehyde) Plywood:

        1) Plywood that meets or exceeds the standards set forth by the APA for structural use panels.
        2) For casework core being manufactured without the use of urea formaldehyde.
        3) For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.

    c. FSC M-3i Particleboard:

        1) For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.

    d. FSC Plywood:

        1) For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.

B. Joinery:

    1. Mechanical Joinery:

        a. All cabinet body components shall be secured utilizing concealed interlocking mechanical fasteners as approved by the AWI Quality Standards 8th Edition-2003 Sections 400A-T-12, 400B-T10 and 1600-T-11.

C. Surface Material:

    1. Acceptable laminate color, pattern, and finish as either scheduled or otherwise indicated on drawings or as selected by Architect from manufacturer's standards types and nominal thickness including:

        a. Vertical surface decorative grade VGS: .028" thick
        b. General purpose decorative grade HGS: .48" thick
        c. Cabinet decorative liner grade CLS: .020" thick
        d. Non-decorative backer grade BKH: .028" thick
        e. Thermally fused melamine laminate.
        f. Chemical resistant decorative laminate.

D. Edge banding:

    1. PVC

        a. Shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Edging shall be available in a variety of color options.

E. Adhesives:

1. PVA

    a. Adhesive shall be mechanically applied.
    b. NAUF, no VOC

2. EVA

    a. Adhesive shall be mechanically applied.

F. Protective coating option:

1. All surfaces, including: pulls, hinges, countertops and edge banding be coated with OEM-treated, quat-silane antimicrobial AEM 5772 from AEGIS Environments.

2.03 FABRICATION

A. General Cabinet Body Construction:

1. Cabinet Box Style shall be Reveal Overlay.

2. Cabinet Box Core shall be Particleboard.

3. Bottoms and ends of cabinets, and tops of tall cabinets and tops and bottoms of wall cabinets (all structural components) shall be 1”-inch thick.

4. All panels shall be manufactured with balanced construction.

5. Fixed interior components such as dividers, and cubicle compartments shall be full 3/4" thick and attached with concealed interlocking mechanical fasteners.

6. Cabinet body exterior surfaces shall be: VGS.

7. Cabinet finished interior options shall be: Finished at opens. (Decorative thermally fused).

8. Cabinet body interior surfaces shall be: Thermally Fused.

9. In closed cabinets body front edge shall be: .020" PVC

10. Mounting stretchers are 3/4" thick structural components fastened to end panels and back by mechanical fasteners, and are concealed by the cabinet back.

11. When the rear of a cabinet is exposed, a separate finished 3/4" thick decorative laminate back panel shall be provided.

12. Backs of cabinets are 1/2" thick surfaced both sides for balanced construction and fully captured on both sides and bottom.

13. A 5mm diameter row hole pattern 32mm (1-1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.

14. An upper 3/4" thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. This stretcher is also fastened to the full sub-top thus capturing the back panel.

B. Base Cabinet Construction:

1. All base cabinets, except sink cabinets, shall have a solid 3/4" thick sub-top of core (as specified above), fastened between the ends with interlocking mechanical fasteners.

2. Sink cabinets with a split removable back panel shall have a formed metal front brace, and steel corner gussets shall be utilized to support and securely fasten top in all four corners. Front brace shall be powder coated black.

C. Tall Cabinet Construction:

1. All tall cabinets shall be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate 3/4" thick stretcher located behind the back panel and be secured between the cabinet ends with mechanical fasteners. The stretcher shall be secured to the shelf through the back with #8 x 2" plated flat head screws.

D. Wall Cabinet Construction:

1. All wall cabinet bottoms shall be ¾”-inch thick core (type specified above), mechanically fastened between end panels and secured to the bottom back stretcher. A lower 3/4" thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. The stretcher is also secured through the back and into the cabinet bottom. Wall cabinets over 36” in width shall receive a fixed intermediate partition.

2. All wall cabinet exterior bottoms shall be: Match Exterior Surface.

3. All wall cabinet tops shall be: ¾-inch.

E. Tall and Wall Cabinet Top Edges shall be: .020" PVC at Top of End Panels, Stretchers & Back.

F. Tall, Wall and Hutch Tops shall be: HPL to Match Exterior Surface.

G. Tall, Wall and Hutch Upper Door Reveal shall be: 15mm Reveal.

H. Toe Base of Cabinet:

1. Individual bases shall be constructed of: Pressure treated plywood factory applied to base and tall cabinets and shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall, also to conceal the top edge of applied vinyl base molding (not supplied by casework manufacturer). There shall be a front to back center support for all bases over 30" wide.

2. Toe Base Height: 96mm.

3. Toe Base Options: Attached.

I. Drawer Fronts and Solid Doors:

1. All drawer fronts and solid door components shall be: Particleboard surfaced both sides for balanced construction.

2. Options shall be: HPL Door and Drawer Front Exterior and Grade CLS on Interior or Corkboard Doors as selected by Architect.

3. Surfaces shall be: HPL Grade VGS.

4. Door and drawer front edge shall be: 3mm PVC.

J. Drawer Boxes:

1. Drawer box constructed with a full 1/2" thick core shall be: Particleboard non-racking, non-deflecting platform bottom that is carried directly by “L” shaped, bottom mount drawer glides.

2. Drawer box at finished interiors shall be: Surface to Match Standard Interior.

3. Standard: Slides are secured with 1-1/4" long screws driven through the platform and into the sides. Drawer box sides, backs, sub-front, and bottom shall be 1/2". The top edge shall be nominal 1mm (.020") PVC matching the drawer color. Drawer box corners shall be joined with fluted hardwood dowels and glue spaced at a minimum of 32mm on center. Drawer box fronts shall be removable and attached to drawer box sub-front with screws from inside of drawer. Horizontal parting rails between drawers shall be 3/4" thick core, with balanced surfaces, secured to and further reinforcing cabinet ends. File drawer box shall have full-height sides supporting a heavy-duty support rail for hanging file folders.

K. Doors:

1. Solid Doors shall be: ¾" thick core.

2. Glazed Doors, Framed shall be:

a. Hinged or sliding 3/4" thick, framed doors shall be: Tempered Glass Panels. Panels must be 1/4" thick. Glazing panel shall be set into the doorframe with the use of a separate molding. Glazing shall be held in place with removable stops.

3. Glazed Doors, Frameless shall be:

a. Sliding, minimum 1/4" thick tempered glass panels. All edges to be radius ground and polished.

4. Sliding Doors shall be:

a. Extruded aluminum upper track with anodized finish. All tall cabinets shall receive two hanging brackets per door with two rollers per bracket. All other cabinets shall receive two hanging brackets per door with one roller per bracket. The bottom of door shall be captured in a retainer to prevent doors from swinging in or out.

5. Pocket Doors shall be:

a. Zinc plated, self-closing, three-way adjustable geometric door hinge with precision steel ball bearing slides.

L. Shelves:

1. Adjustable:

a. Adjustable shelves shall be: Particleboard with balanced surfaces.

b. Adjustable shelves in closed cabinets shall be: 1" for All Shelves.

c. All adjustable shelves in open cabinets shall be: 1" thick, except for special use cabinets such as mail, cubical, instrument or locker type units.

d. Adjustable shelf edge on open cabinets shall be: 3mm PVC on Front Edge.

e. Adjustable shelf edge on closed cabinets shall be: .020" PVC on All Four Edges.

f. Adjustable shelf shall be set back: 15mm from the front or 23mm setback option when locks are used.

2. Fixed:

a. Fixed shelves shall be: Particleboard.

b. Fixed shelves shall be: 1" for All Shelves.

c. Fixed shelf surfaces on closed cabinets shall be: Match Interior Selections.

d. Fixed shelf surfaces on open cabinets shall be: HPL to Match Exterior.

3. Wall shelving selections for model numbers R204, R205, R206 only shall be:

a. 3mm PVC.

b. Particleboard

c. Thermally Fused

4. Wire Shelves shall be white, plastic coated.

5. Hardboard Shelves shall be ¼" thick tempered hardboard. All hardboard shall have a “S2S” surface finish.

M. Specialty Products:

1. Countertops:

a. High-pressure decorative laminate, nominal 1-1/2" thick buildup, conforming to NEMA Standard LD3-2005 and ANSI A161.2-1998.

1) General Purpose: HGS.

2) Laminate bonded to M-2: Particleboard core with PVA rigid adhesives. Core shall be balanced with backing Grade BKL.

3) All joints shall be secured with biscuits for alignment and tight joint fasteners.

4) Provide 4" high back splashes with thickness matching countertop thickness where shown and at all ends abutting walls and adjacent cabinets.

5) Provide edges: 3mm

6) The maximum lengths of HPL buildup particleboard tops is 12’ and the maximum lengths of HPL buildup plywood tops is 8’.

2.04 FINISHES

A. Plastic Laminate Casework Colors:

1. High Pressure Laminate is available in non-premium, non-specialty and manufacturers' standard suede finishes from our select laminate manufacturers, including:

    a. Wilsonart® in a "60" or "38" matte finish and Standard: Formica in a "58" finish, unless otherwise noted on the Construction Documents.

    b. Color: Specialty and other manufacturer finishes are available with additional cost and longer lead times.

2. Thermally Fused Melamine Laminate that meets performance requirements of ANSI/NEMA 3 LD – 2005 for GP-28.

    a. Natural Almond (Wilsonart D30), Fashion Grey (Wilsonart D381), Frosty White (Wilsonart 1573).

3. Cabinet Liner .020" thick, high-pressure cabinet liner conforming to ANSI/NEMA 3 LD – 2005, Grade CLS. Surface texture shall be similar to exterior finish. Color shall match interior.

    a. Almond, Grey, White.

B. Accessories:

1. Hinges:

    a. 5-Knuckle Hinge / Reveal Overlay: Three finishes are available as standard in epoxy powder coat: Black, or Almond, or Platinum.

2. Pulls:

    a. 96mm Stainless Steel

    b. Epoxy Coated Wire Pulls shall be available as standard in: Almond, Platinum, or Black. Or as specified by Architect.

C. Glazed Door Trim shall be one of our standard colors: Black, White, Almond, or Grey.

D. Countertop Supports shall be in one of our standard colors: HPL to match.

E. Round Grommet shall be in one of our standard colors: Black.

F. Round Grommets shall be in one of our standard colors: Black.

2.05 ACCESSORIES

A. Hardware:

1. Hinges

    a. 5-Knuckle Hinges/Reveal Overlay: Standard: Hinges shall be: .095" thick settle five-knuckle hospital-tip, institutional Grade (Grade 1 per ASNI/BHMA A156.9) quality with .187" diameter tight pin. Each hinge shall be secured with a minimum of nine No. 8 screws. Hinge shall permit door to swing 270 degrees with binding. Doors less than 48" in height shall have two hinges. Doors have over 48" in height shall have three hinges.

2. Pulls:

a. One pull shall be: located at the centerline of the drawer, regardless of width, to ensure ease of operation and maximize drawer slide life.

1) Epoxy coated wire pull, 8mm diameter with 96mm O.C. mounting holes.

3. Drawer Slides:

a. Full extension, bottom mount epoxy coated with captive roller and positive in stop. Slide shall have 100lb. load rating, must be: full extension, and prevent drawer fronts from contacting the cabinet body. Drawer slides must meet or exceed Grade 1 requirements per ANSI/BHMA.

4. Wall Shelving Hardware:

a. Heavy-duty wall shelving hardware, including standards and brackets, are available in an anochrome finish.

b. Bracket Mounted Shelf Core shall be: Particleboard.

c. Bracket Mounted Shelf Edge shall be 3mm.

d. Bracket Mounted Shelf Surface shall be: VGS Laminate.

5. Shelf Clips:

a. Shelf clips shall be injected molded clear plastic, with a double pin engagement 32mm on center and shall have 3/4" and 1" anti-tip locking tabs as approved in AWI 400B-T-9 for premium Grade. Shelf clips shall be: single pin plastic shelf clip with anti-tip locking tabs, used for all 1/4" hardboard shelves.

6. Coat Hooks shall be Zinc plated, single prong and double prong.

7. Closet Rods shall be Zinc plated rod, 1" diameter with captive sockets.

8. Locks:

a. Lock Locations:

1) Locks at All

b. Lock Type:

1) Standard Lock – National: Five disc tumbler cam locks, chrome plated steel faceplate. All locks keyed alike or keyed differently by room and mater keypad. Shall permit a minimum of 50 keying options. Lock core is removable permitting owner to easily change lock arrangements. Inactive door of base and wall cabinets shall be: secured by using an elbow catch, or a chain pull for tall cabinets].

9. Casters:

a. Shall be available in both 4" (3" diameter wheel) and 6" (5" diameter wheel) nominal heights. 4" casters must have a minimum load rating of 165 lbs per caster and the 6" casters must have a minimum load rating of 200 lbs per caster. Shall be ball bearing with 360° swivel. Shall have non-marring wheels available in both locking and non-locking.

10. Catches:

a. Chain Pulls shall be zinc plated, spring loaded door catch used to hold door securely shut.

b. Chain Stops shall be zinc plated, looped chain used to limit door swing as specified, mounting plate at each end of chain shall use (4) #7 x 5/8" screws to secure to cabinet door and end panel. They shall be on cabinets at adjoining walls and where casework and countertops can interfere with the door swing of the tall cabinet.

c. Elbow Catch shall be chrome plated, spring loaded, used to hold non-locking door securely shut.

d. Roller Catch, (not used with self-closing hinges) shall have: heavy-duty, spring-loaded roller, with molded plastic bumper mounted at door top to keep door securely shut.

e. Magnetic Catch, (not used with self-closing hinges) shall have: white plastic housing with two 32mm spaced, elongated holes for screw-attachment to allow adjustability.

f. Catches shall be: 1 Roller at All.

11. Tote Tray shall be white, high impact resistant polystyrene, with label holder permanently attached to face of tray. Supported by individual polycarbonate channels mounted to cabinet ends and partitions with two integral 5mm diameter pins and secured with one-euro style screw. Height adjustable on 32mm (1-1/4") centers.

12. Countertop Supports:

    a. Powder coated, formed metal supports. Must provide attachment points between countertop and wall.

PART 3 – EXECUTION

3.01 INSTALLERS

A. Installation shall be: by casework manufacturer's authorized representative.

3.02 INSTALLATION

A. Casework shall not be: installed until concrete, masonry, and drywall/plaster work is dry.

    1. If ambient conditions are not met at the time of requested delivery, the general contractor or owner must provide Case Systems a letter that releases manufacturer from any liability and responsibility from any warranty or damage resulting from not complying with required ambient conditions.

B. Casework shall be: installed plumb and true and is to be securely anchored in place.

C. The casework contractor shall verify all critical building dimensions prior to fabrication of casework.

D. Provide all labor for unloading, distribution, and installation of casework and related items as specified.

E. All casework shall be: securely anchored to horizontal wall blocking, not to plaster lathe or wall board.

F. The casework manufacturer shall re-configure the casework arrangements to dimensions requiring 2-1/2" or less of filler at each end of wall-to-wall elevations, and to ensure a complete and satisfactory installation.

G. The casework installer shall remove all debris, sawdust, scraps, and leave casework spaces clean.

H. All casework must be installed by casework installer plumb and level, adjust all doors, drawers and hardware to comply with manufacturers specifications and operate properly.

END OF SECTION

DIVISION 21 – FIRE SUPPRESSION

SECTION 210500 – FIRE SPRINKLER SYSTEM WORK INCLUDED

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The contractor shall be a licensed fire suppression professional and a certified fire sprinkler contractor.

B. Include all labor, materials, and appliances and perform all operations in connection with the installation of all related work, complete, in strict accordance with the Contract Drawings, NFPA Pamphlet 13, latest edition and as specified herein, and state and local codes and the local fire marshal.

C. The Contractor must review the drawings and visit the job site and determine for himself the extent of the work involved. No extras shall be entertained due to any alleged misunderstanding of the work involved.

D. The Contractor shall furnish and install a complete fire sprinkler system as specified herein. The following is a general listing, not necessarily complete, of the work to be installed under this section.

E. Where require by code or the design documents, provide and install all sprinkler heads and the associated piping systems including the preassembled alarm valve assemblies, hangers, indicating valves, instrumentation, water supply piping, air compressor, control wiring, detection wiring and alarm wiring. Field adjustment to eliminate interferences and the installation of additional heads as deemed necessary will be provided by the Contractor. In addition, a minimum of six (6) spare sprinkler heads are to be provided in a suitable cabinet along with all required test pipes and a set of test gauges.

F. Provide Siamese connection for fire department use, so located as to provide clear and full access to all outlets. The thread type shall match local Fire Department connections.

G. Provide and install an air compressor of adequate size per current NFPA 13, with associated piping, valves, and controls for the purpose of pressurizing the pipe system.

H. The preaction fire sprinkler system shall be designed for occupancy delineated on the contract drawings and in accordance with latest version of applicable NFPA Standards.

I. Where required, provide and install all alarms, indicating devices, and actuating switches (i.e., pressure switches), as required including tamper switches and fire alarm interlock to sound fire alarm system upon water flow.

J. Provide and install all electrical wiring/connections, both power, detection and control from the incoming electric service to the fire protection equipment requiring same.

K. Perform such tests as may be required by the Engineer, local municipality, or governing agency having jurisdiction.

L. Perform all filing for permits as required by local municipality or governing agency including paying all fees required for same.

M. Procurement of any certificates of approval as required by the local municipality or governing agency shall be the responsibility of the installing contractor. Submit written acceptance from the reviewing authority before requesting final payment.

N. The Contractor shall furnish a hydraulically designed system. All calculations must be performed by a computer program acceptable to the reviewing agency. The Contractor must submit calculations and drawings as required by the reviewing agency and shall obtain their approval in writing for submission to the Engineer.

1.02 PIPE, FITTINGS, VALVES, AND ACCESSORIES

A. All interior sprinkler piping shall be welded or seamless steel pipe, Schedule 40, in accordance with ASTM A-53.

B. All sprinkler piping fittings shall conform to the requirements of current NFPA 13 code and shall be rated for a minimum working pressure of 175 PSIG.

C. All sprinkler piping and fittings may be of the grooved type. Fittings shall be as manufactured by the Victaulic Corporation, 2 bolt type. Where threaded pipe and fittings are employed, teflon tee or teflon paste shall be used on the male thread only.

D. Where required, all air compressor piping shall be Type "L" copper tube conforming to ASTM B-88 made up with wrought copper fittings and joints fluxed and soldered using ‘lead-free’ solder.

E. Where required, all compressed air fittings shall conform to ANSI B16.22 for wrought copper and B16.18 for cast bronze.

F. Sprinkler heads shall be bronze construction of ordinary classification. Sprinkler heads shall be the product of Viking Corporation, and listed in the Factory Mutual System Approval Guide latest edition. Sprinkler heads shall be ‘White’ Horizontal Sidewall/Pendent Concealed with decorative ceiling ring and cap.

G. Orifice sizes shall be in accordance with the requirements of the Hydraulic Calculation. All sprinkler heads, types, and finishes shall be submitted to the Engineer for approval.

H. Pressure gauges as manufactured by Dresser Industries, Inc., "Ashcroft" brand, Type 35-20-00A-021-XUL Series (0 - 250 PSI) shall be provided upstream and downstream of the alarm valve.

I. The indicating valve (outside screw and yoke gate valve), the fire department and sprinkler check valves shall have a minimum rating of 175 PSIG and shall be as manufactured by Jenkins Brothers or Crane Company and shall be listed in the Factory Mutual Systems Approval Guide latest edition.

J. Where required, all compressed air valves shall be of cast bronze construction as manufactured by Jenkins Brothers or Crane Company and shall be U.L. listed for sprinkler service. Valves shall be rated 175 PSIG minimum.

K. The fire department connection shall be a wall Siamese, rated 175 PSIG. Siamese shall be Potter-Rhoemer or approved equal.

L. Provide an air compressor capable of delivering not less than 16.00 cubic feet of free air per minute and maintaining an air pressure of 102 PSIG on the tank. Compressor shall have the necessary connections to the preaction system to insure recharge of the piping within 30 minutes. The air compressor shall be provided with across the line starter and all necessary controls. The air compressor shall be provided as an integral part of the integrated fire protection system cabinet.

M. All sprinkler piping shall be hung and braced in accordance with the latest applicable Articles of NFPA 13.

1.03 ELECTRICAL

A. Contractor shall install all branch circuit wiring from incoming electric service, unless noted otherwise (including properly sized circuit breakers) to all fire sprinkler system components. These shall include but not be limited to: air compressor, water flow alarms, alarm bells, and alarm valves. All equipment shall be wired in strict accordance with the manufacturer's direction and the National Electric Code.

B. All electric work shall be performed by a licensed electrician and all branch circuits shall be clearly identified at the service panel. Contractor shall provide an Underwriters Certificate for all electric work installed under this Section.

1.04 TESTS

A. The entire sprinkler system including make-up water and compressed air piping shall be subjected to a hydrostatic test pressure of 225 PSIG for a period of 2 hours. Leaks will be repaired immediately, and the test repeated for the full term and pressure until accepted.

1.05 DRAWINGS

A. The accompanying drawings are included to show the building configuration. The contractor has the option to utilize a schedule or hydraulic pipe sizing method.

B. Make application to the Owner's Insurance Company for review and acceptance of the sprinkler systems. Submit to the Engineer three sets of sprinkler drawings, bearing the acceptance stamp of the Owner's Insurance Company and AHJ. Before requesting final payment, include all fees, taxes, and changes for the above work in the bid price quoted.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220000 – PLUMBING GENERAL PROVISIONS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. This Section contains General Provisions related specifically to the Plumbing Work.

1. Quality Assurance
2. Protection
3. Coordination and Sequencing
4. General Completion
5. Painting and Finishing
6. Excavation for Plumbing Work
7. Concrete for Plumbing Work

B. Drawings and General Provisions of Contract, including General and Supplementary Conditions, apply to this section.

1.02 GENERAL

A. This Contractor, as well as sub-contractors for his work, must carefully read the “Instructions to Bidders” and study the plans and specifications.

1. It is the intention of these specifications to provide for the furnishing and installing of the plumbing equipment complete as shown and specified. Any work or changes which may be evidently necessary to complete the installation shall be furnished by the Contractor as being included in this Contract.

2. During the course of the work, should any ambiguities or discrepancies be found in the specifications to which the Contractor has failed to call attention to before submission of his bid, then the Engineer shall interpret the intent of the specifications, and the Contractor hereby agrees to abide by the Engineer’s interpretation and agrees to carry out the work in accordance with the decision of the Engineer. It is expressly stipulated that neither the instructions nor the specifications shall take precedence, one over the other, and it is further stipulated that the Engineer may interpret or construe the specifications of the work, and of that question the Engineer shall be the sole judge.

3. Where no specified kind of quality of material is given, a first class standard article as approved by the Engineer shall be furnished. The specifications do not undertake to illustrate or set forth every item necessary for the work.

4. Small details not usually shown or specified but necessary for its proper installation and finishing shall be included in the Contractor’s estimate, the same as if hereby specified or shown.

1.03 QUALITY ASSURANCE

A. Laws, Permits, Inspections.

1. Comply with the latest revisions of New York State Uniform Fire Protection and Construction Code, International Plumbing Code, any Local Codes or Regulations that apply.

2. Underwriters Laboratories label required for all electrical materials carrying 50 volts or more.

3. Comply with New York State Energy Conservation Construction Code, as referenced in NYCRR.

4. Comply with N.Y. State Education Department Manual of Planning Standards.

5. Comply to requirements of drawings and specifications that are in excess of governing codes.

6. Comply with section 1621 of the New York State Building Code for seismic requirements.

7. Do not install work as specified or shown if in conflict with governing code. Notify Engineer and request direction.

8. Pay all Inspection and Permit fees.

9. Provide Certificate of Inspection from all governing authorities.

B. Reference to technical society, organization, body or section made in accordance with the following abbreviations:

1. AGA – American Gas Association
2. AIA – American Institute of Architects
3. AMCA – American Moving and Conditioning Association, Inc.
4. ANSI – American National Standards Institute.
5. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers
6. ASME – American Society of Mechanical Engineers
7. ASTM – American Society of Testing Materials
8. AWSC – American Welding Society Code
9. AWWA – American Water Works Association
10. CS – Commercial Standard
11. FS – Federal Specification
12. IEEE – Institute of Electric and Electronics Engineers
13. NEC – National Electric Code
14. NEMA – National Electrical Manufacturer's Association
15. NFPA – National Fire Protection Association
16. NYBFU – New York Board of Fire Underwriters
17. NYCRR – Codes, Rule and Regulations of the State of New York.
18. NSF – National Sanitation Foundation
19. PDI – Plumbing and Drainage Institute.
20. SMACNA – Sheet Metal and Air Conditioning Contractors National Association
21. USASI – United States of America Standards
22. UL – Underwriters' Laboratories, Inc.

C. Contractor submission of equivalent or substitute items other than those specified is at Contractor convenience only. If a substitution or equivalent is accepted, the Contractor shall coordinate the installation of the substitute or equivalent and make all associated changes required. The Contractor also waives any claim for additional costs associated with the substitute / equivalent which becomes apparent before, during or after installation. The Contractor agrees to bear any and all additional costs to all other contractors or subcontractors which are caused by the incorporation of the substitution / equivalent.

1.04 PROTECTION

A. Protect equipment from damage, including water, chemical, mechanical injury and theft.

B. Replace damaged equipment or components.

C. Close and waterproof between sleeves, openings, pipes and voids in walls, floors and foundations to prevent entrance of water or moisture.

D. Holes made in firewalls, partitions, fire stops, shall be patched to maintain fire rating integrity.

E. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.

F. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

G. Protect flanges, fittings, and piping specialties from moisture and dirt.

H. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.05 COORDINATION AND SEQUENCING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for chases, slots and openings in building structure during progress of construction, to allow for plumbing installations.

C. Coordinate the installation of required supporting devices set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Section 15052A“Access to Plumbing Work.”

G. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

H. Coordination with other trades: Right-of-Way as follows:

1. Light Fixtures.
2. Fire Suppression.
3. Steam and condensate piping.
4. Hot water supply and hot water return piping.
5. Drain Pipes and Vents
6. Ductwork
7. HVAC Piping
8. Domestic Water Piping
9. Electrical Conduit

1.06 GENERAL COMPLETION

A. Oiling Equipment.

1. Lubricate equipment and motors in accordance with manufacturer's requirements. Provide lubrication chart in frame mount where directed by Owner.

B. Instructions to Owner's Representative.

1. Give notice to Engineer when all systems are installed and operating.

2. Obtain name of Owner's Representative to receive instructions.

3. Schedule instructions of Owner's Representative by manufacturer's representative and instruct Owner in system installation and operation for all equipment installed under this contract.

C. Provide Operation and Maintenance manuals in accordance with the Requirements of Division 01 "Contract Closeout" Section.

1.07 PAINTING AND FINISHING

A. Refer to Division 09, Section "Painting" for field painting Requirements.

B. Damage and Touch-up: Repair marred and damaged factory painted finishes with materials and procedures to match original factory finish.

1.08 CUTTING AND PATCHING – SEE SPECIFICATION SECTION 220020

1.09 EXCAVATION FOR PLUMBING WORK

A. Description of Work: Types of excavation for plumbing related work specified in this section include:

1. Underground plumbing utilities and services.
2. Underground tanks and equipment enclosures.
3. Interior and Exterior water distribution systems to 5 feet outside of the building or where indicated on the plans.
4. Interior and Exterior sanitary and storm drainage systems to 5 feet outside of the building or where indicated on the plans.

B. Project Conditions.

1. Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Liabilities arising out of performance of work is responsibility of Contractor doing excavation.

2. Protect persons from injury at excavations by barricades, warnings, and illumination.

3. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install plumbing work on frozen excavation bases or sub bases.

1.10 CONCRETE FOR PLUMBING WORK

A. Types of concrete for plumbing related work specified in this section include:

1. Lean concrete backfill to support plumbing work.

2. Encasement of mechanical work.
3. Plumbing equipment foundations and housekeeping pads.
4. Inertia bases for isolation of plumbing work.
5. Rough grouting in and around plumbing work.
6. Patching concrete cuts to accommodate plumbing work.
7. Thrust block.

1.11 REBATES

A. The Plumbing Contractor shall assist the Owner in applying for any available rebates from manufacturer's, utility companies, etc. on equipment or materials installed under the contract. Provide all required documentation and assist in the completion of applications as required to complete the rebate process. All proceeds from rebates remain the property of the Owner.

PART 2 – PRODUCTS

2.01 BACKFILL MATERIALS

A. Sub base Material (Bedding): Graded mixture of gravel, sand crushed stone or crushed slag.

B. Backfill Material: Soil material free of large stones, shale, wood and similar material.

2.02 CONCRETE

A. Concrete installed by this division shall comply with Division 3 Specifications for Concrete.

PART 3 – EXECUTION

3.01 EXCAVATION - GENERAL

A. Do not excavate for plumbing work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.

B. Excavate with vertical sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross bracing to sustain sides of excavation. Remove sheeting and cross bracing during backfilling wherever such removal would not endanger work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.

C. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearance.

D. Depth for direct support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand excavate bottom cut to accurate elevations, undercut at pipe hubs.

E. Depth for sub base support: For large piping (6" pipe size and larger), tanks, and where indicated for other plumbing work, excavate for installation of sub base material in depth indicated or, if not otherwise indicated, 6" below bottom of work to be supported.

F. Depth for unsatisfactory soil or rock conditions: Where directed, (because of unsatisfactory conditions at bottom of indicated excavation), excavate additional depth as directed to reach

satisfactory conditions. Backfill with sub base material compacted as directed, to indicate excavation depth.

G. Store excavated material (temporarily) near excavation, in manner, which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).

1. Dispose of excavated material, which is either in excess of quantity needed for backfilling, or does not comply with requirements for backfill material.

2. Remove unused material from project site, and dispose of it in lawful manner.

3.02 WATER CONTROL

A. Maintain dry excavations for plumbing work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations, protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations and below grade property from being damage by water, sediment or erosion from or through plumbing work excavations.

3.03 BACKFILLING

A. Do not backfill until installed plumbing work has been tested and accepted.

B. Install drainage fill where indicated, and tamp to uniform firm density.

C. Backfill with finely graded sub base material to 6” above wrapped, coated and plastic piping and tanks, or as shown on drawngsand to centerline of other tanks.

D. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

E. Backfill simultaneously on opposite side of plumbing work, and compact simultaneously, do not dislocate work from installed positions.

F. Backfill excavations in 8” high courses of backfill material uniformly compacted to the following densities (% of maximum density, ASTM D1557), using power-driven hand operated compaction equipment.

1. Lawn and landscaped areas: 85% for cohesive soils, 90% for cohesion less soil.

2. Paved areas and roadways: 90% for cohesive soils, 95% for cohesion less soils.

G. Backfill to elevations matching adjacent grades, at time of backfilling excavations for mechanical work. Return surfaces to original condition.

H. After covering piping with 6” layer of approved fill backfill and compact excavations beneath:

1. New foundations.
2. Slabs on grade.
3. Areas to be paved by General Contractor.

3.04 CONCRETE BASES

A. Construct concrete equipment bases of minimum 4 inches higher or as shown on drawings, and not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer’s setting templates for anchor bolt and tie locations.

3.05 CONCRETE GENERAL

A. Concrete installed by this division shall comply with Division 03 Specifications for Concrete.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220010 – CODES, STANDARDS, AND PERMITS

PART 1 – GENERAL

1.01 GENERAL

A. The entire installation shall be made in accordance with State rules and regulations and shall also conform with the standards of the National Board of Fire Underwriters for this installation and the local Board of Fire Underwriters having jurisdiction. The installation shall also comply with air pollution requirements of the State of New York and Industrial Code Rule 4 of the State of New York Department of Labor, Board of Standards and Appeals, dated March 31, 1965, and all other ordinances having jurisdiction.

B. The Contractor shall submit to all authorities having jurisdiction all required applications and shall secure all necessary permits, tests, and inspections required for final approval.

C. Certain standard and staple materials are described by reference to standard specifications. These standards are as follows:

AGA	American Gas Association
ASA-B9	Safety Code for Mechanical Refrigeration
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
CGA	Compressed Gas Association
AWWA	American Water Works Association
CS	Commercial Standard
FS	Federal Specification
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
USASI	United States of America Standards Institute
UL	Underwriters' Laboratories
	New York State Uniformed Fire Prevention and Building Code
IPC	International Plumbing Code

D. All electric facilities shall receive the Underwriters label and be installed in accordance with the latest issue of the National Electric Code requirements.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220020 – CUTTING AND PATCHING

PART 1 – GENERAL

1.01 GENERAL

A. Each Contractor shall be responsible for his cutting and patching. The Contractor shall also be responsible for all finish patching and painting.

B. Each Contractor shall replace and patch any surfaces of any structure disturbed by his operations and his work, even if such operations and work are outside the contract limit. Such replacement, repair, and patching shall be with similar material and shall restore surfaces as they exist, or better.

C. Cut and alter existing materials as required to perform the work. Limit cutting to the smallest amount necessary for proper installation of the work.

D. Where the removal of existing building components necessitates the addition of patching in new materials, such work shall be executed to insure the fire resistance rating of the system and visual continuity with adjacent surfaces, whether or not the remedial work is specifically detailed on the drawings.

E. Perform the removal work with such care as may be required to prevent damage to adjoining construction which is to remain.

F. Do not disturb any existing structure, piping, apparatus, or other construction which must remain unless expressly required by the contract. Where cutting or removals are required in existing construction, do the work in a manner that will safeguard and not endanger the structure and as approved by the Engineer.

G. If unforeseen obstructions are encountered, take all precautions necessary to prevent damage and obtain full instructions from the Engineer before proceeding with the work.

H. Remove from the site all debris and other materials resulting from the alterations and removals, subject to the General Requirements.

I. Fill all voids and patch existing construction and finishes damaged within area of alteration work unless otherwise indicated. Provide new materials to match existing corresponding items as closely as practicable.

J. Any pipe penetrations through fire rated areas shall be accomplished using Hilti fire barrier products in sheets, strips, or caulk using ASTM, UL, and FM standards.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220030 – SCHEDULE OF EQUIVALENCY

PART 1 – GENERAL

1.01 GENERAL

A. Wherever a brand name or manufacturer is named in this specification, it indicates the standard of quality or purpose desired. Where one certain kind, type, brand, or manufacturer of materials is named, it shall be regarded as the standard quality. Where two or more are named, these are presumed to be equal, and the Contractor may select one of those items; if the Contractor desires to use any other kind, type, brand, or manufacturer of material other than named in the specifications, he shall submit a list, with his bid, stating what material, equipment, or method is offered as equal and how it affects the contract price.

B. The equivalency of such items is to be judged by the Engineer whenever offered by bidders as equivalent to the Base Bid items and so reported to the Owner for his ultimate decision.

C. The following manufacturers are approved equivalents for those listed in the specifications:

1. Insulation:

   Johns-Mansville Corporation
   Owens-Corning Fiberglass Corporation
   Knauf
   Certainteed

2. Drains, Cleanouts, Flashing Sleeves, Wall Hydrants, Water Hammer Arrestors, Interceptors, and Fixture Supports

   Zurn Manufacturing Company
   Josam Manufacturing Company
   Jay R. Smith Company

3. Plumbing Fixtures

   Zurn
   American Standard
   Crane Company

4. Fixture Trim

   American Standard
   Chicago Faucet Company
   T & S Brass and Bronze Works

5. Flush Valves

   Zurn
   Sloan Valve Company
   American Standard

6. Toilet Seats

   American Standard
   Olsonite
   C.F. Church Company

7. Access Doors

   Karp Associates, Inc.
   Zurn Manufacturing Company
   Wilcox Steel Company

8. Valves

   Jenkins Brothers
   Lukenheimer Company
   Walworth Company

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220100 – MAINTENANCE INSTRUCTIONS

PART 1 – GENERAL

1.01 GENERAL

A. In addition to the requirements outlined in the "General Provisions", the following information shall be incorporated:

1. Manufacturer's plumbing equipment parts list of all functional components including control diagrams and wiring diagrams of controllers.

2. Step by step instructions for each system including preparation for starting, operation, and shutdown. Provide full maintenance manual describing procedures for each new piece of equipment. In addition, provide a video showing / describing step by step instructions for maintenance of each new piece of equipment.

3. Twelve-month maintenance schedule for each type of equipment.

4. Possible breakdowns and repairs for each type of equipment.

5. List of nearest local suppliers for all equipment.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220300 – PLUMBING BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. This Section includes the following basic plumbing materials and methods to complement other Division 22 Sections.

1. Submittals.
2. Pipe joining materials and installation instructions common to piping systems.
3. Piping specialties: Escutcheons, dielectric fittings, sleeves and seals.
4. Non-shrink grout for equipment installations.
5. Drip pans.
6. Pipe supports: Hangers, clamps, support spacing, building attachments, shields and saddles, flashing, miscellaneous materials, and anchors.
7. Field fabricated metal and wood equipment supports.
8. Firestopping.

B. Pipe and pipe fitting materials are specified in piping system sections.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. NSF 372 and ANSI 61

1.03 SUBMITTALS

A. General - Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for following piping specialties:

1. Mechanical sleeve seals.
2. Identification materials and devices.

C. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.04 STANDARDS FOR MATERIALS AND WORKMANSHIP

A. All materials and workmanship shall, at a minimum be in accordance with (in no order of precedence):

1. New York State Codes – latest edition as adopted by the Authority Having Jurisdiction, unless otherwise noted.

2. State and municipal Building Codes and related subcodes.

3. Occupational and Safety Act (OSHA) Requirements.

4. Rules and Regulations of the Authority Having Jurisdiction applicable to the work.

5. National Electrical Standards Association Standard for Good Workmanship in Electrical Construction (NECA-1)

6. Serving utility's rules and regulations for providing service.

7. Contract Drawings and Specifications.

8. Manufacturer recommended installation instructions, practices and procedures for the products being utilized or installed.

9. Where conflicts arise between the above, the more stringent requirement shall be adhered to.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All fittings NSF 372 ANSI 61.

2.02 PIPE JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.

    a. Full-Face Type: for flat-face, Class 125 cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: for raised-face, Class 250 cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8-inch-thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

2.03 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe, tube and insulation of insulated piping.

2. Outside Diameter: Completely cover opening.

3. Cast Brass: One-piece, with set-screw.

a. Finish: Rough brass.
b. Finish: Polished chrome plate.

4. Cast Brass: Split casting, with concealed hinge and set-screw.

a. Finish: Rough brass.
b. Finish: Polished chrome plate.

5. Stamped Steel: One-piece, with set screw and chrome plated finish.

6. Stamped Steel: One-piece with spring clips and chrome plated finish.

7. Stamped Steel: Split plate with concealed hinge, set-screw, and chrome plated finish.

8. Stamped Steel: Split plate with concealed hinge, spring clips and chrome plated finish.

9. Cast-Iron Floor Plate: One-piece casting.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.

2. Insulating Material: Suitable for system fluid, pressure and temperature.

3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg F temperature.

4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.

5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers and steel backing washers.

a. Provide separate companion flanges and steel bolts and nuts for 150 or 300 psig minimum working pressure to suit system pressures.

6. Dielectric Couplings: Galvanized steel coupling, having inert and non-corrosive, thermoplastic lining, with threaded ends and 300 psig minimum working pressure at 225 deg F temperature.

7. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive, thermoplastic lining, with combination of plain, threaded or grooved end types and 300 psig working pressure at 225 deg F temperature.

C. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

D. Sleeves: The following materials are for wall, floor, slab and roof penetrations.

1. Steel Sheet-Metal: 24 gage or heavier, galvanized sheet metal, round tube closed with welded longitudinal joint.

2. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.

3. Cast-Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.

4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.

    a. Penetrating Pipe Deflection: 5 percent without leakage.
    b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111 of housing and gasket size as required to fit penetrating pipe.
    c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
    d. Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.

5. Cast-Iron Sleeve Fittings: Commercially-made, sleeve having integral clamping flange, with clamping ring, bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with set screws.

2.04 VALVES

A. Refer to individual piping system specifications section in Division 22 for special valves not listed below.

B. General

1. Valves shall be installed only in upright vertical or horizontal positions unless specifically otherwise required by the drawings.

2. All valves shall be installed in accessible locations to facilitate easy removal for repair or replacement. Where not possible provide access doors. Refer to 220555.

3. All gate and globe valves shall be designed for repacking when wide open under pressure.

4. Domestic water system valves 3/4" and smaller and all balancing valves shall be globe type.

5. All valves of the same type shall be the products of a single manufacturer and shall comply with ANSI B31.1.

6. All valves for domestic water use shall be no lead type in accordance with NSF-372 ANSI 61.

C. Gate Valves

1. Cold, hot, and hot water return, 2" and smaller: Ball type solder end connections. Jenkins, Nibco, or equal Type B. 3" and larger gate valve: Jenkins, Nibco, or equal Type 1, Class "A", Style 3.

D. Globe Valves

1. 3" or smaller: Jenkins, Nibco, or equal. Over 3": Jenkins, Nibco, or equal, Type 1 with cast iron body and bronze trim.

E. Check Valves

1. 3" and smaller: Jenkins, Nibco, or equal, Type IV, Class "A".

2.05 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

2.06 DRIP PANS

A. Provide drip pans fabricated from corrosion resistant sheet metal with watertight joints, and with edges turned up 2-1/2 inches. Reinforce top, either by structural angles or by folding over according to size. Provide hole, gasket, and flange at low point for watertight joint and 1-inch drain line connection.

2.07 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports. Hangers and supports shall be in complete conformance with Chapter 3 of the New York State Plumbing Code. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper plated hangers and supports for copper piping systems.

B. Adjustable steel clevises.

1. Material: Carbon steel, copper plated for copper piping.
2. Finish: Black or copper plated.
3. Adjustment: Hanger to be adjustable for vertical height of pipe without removing the pipe.

2.08 VERTICAL PIPING CLAMPS

A. Two bolt riser clamp.

1. Material: Carbon steel copper plated for copper piping.
2. Finish: Black or copper plated.

2.09 HANGER ROD AND SPACING

ROD SIZE AND SPACING SCHEDULE

Pipe Size	Maximum Spacing		Rod Size
	Steel	Copper	
1/2 to 1	6 ft.	6 ft.	3/8"
1-1/4 to 1-1/2	6 ft.	6 ft.	3/8"
2	12 ft.	10 ft.	3/8"
2-1/2 - 3-1/2	12 ft.	10 ft.	1/2"
4 - 5	12 ft.	10 ft.	5/8"
6	12 ft.	10 ft.	3/4"
8 - 12	12 ft.		7/8"
14 - 16	12 ft.		1"

Note: Cast Iron - support at every hub or coupling 5 ft. maximum spacing.

2.10 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated provide factory fabricated building attachments of one of the following types listed, selected by Installer to suit building substrate conditions. Select size of building attachments to suit hanger rods. Provide copper plated building attachments for copper piping systems.

B. On Structural Steel:

1. For pipes 2" and smaller: C clamps with lock nuts similar to Anvil figure 86.
2. For pipes 5" and larger: Use beam clamps similar to Anvil figure 228 or 292.

C. On New Masonry:

1. Use concrete inserts similar to Anvil figure 281.

D. On Existing Concrete:

1. Use expansion case similar to Anvil figure 117.

E. On Wood:

1. Use coach screw rods Anvil figure 142. Ceiling flanges Anvil figure 153, or fabricated angle clips. Use wood drive screws or lag bolts as fasteners.

2.11 SHIELDS AND SADDLES

A. General: For insulated piping.

B. Shields: 16-gauge galvanized metal.

C. Protection saddles:

1. Hardwood block
2. Steel saddle Anvil 160 series

2.12 FLASHING MATERIALS

A. General: Provide flashings for each penetration of plumbing systems through roofs or waterproof membranes.

B. Molded Pipe Flashing: Compatible with single ply membranes with which it is used and manufactured by membrane manufacturer.

C. Coated copper flashing: Provide cold-rolled sheet copper (ANSI/ASTM B 370), of proper temper for applications shown and required forming, coated on one side with not less than 0.06 lbs. per sq. ft. of antimony (ANSI/ASTM B 101, Type I, Class A), weighing 1.06 lbs. per sq. ft., except as otherwise indicated.

D. Bituminous coating: FS TT-C-494, or MIL-C-18480, or SSPC-Paint 12, cold applied solvent type bituminous mastic coating for application in dry film thickness of 15 mils per coat.

2.13 MISCELLANEOUS MATERIALS

A. Metal framing: Provide products complying with NEMA.

B. Steel plates, shapes and bars: Provide products complying with ANSI/ASTM A 36.

C. Heavy duty steel trapezes: Fabricate from steel shapes selected for loads required, weld steel in accordance with American Welding Society (AWS) standards.

D. Pipe guides: Provide factory fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two section outer cylinder and base with a two section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.14 ANCHORS

A. Fabricate pipe anchors from 3 x 3 x 1/2" angle.

B. Use pipe protection saddles one size larger than piping.

PART 3 – EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15A specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordinate drawings.

C. Pitch piping at low points. Provide Manual Blowdown for maintenance.

D. Install piping at indicated slope.

E. Install components having pressure rating equal to or greater than system operating pressure.

F. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

G. Install piping free of sags and bends.

H. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

I. Install piping tight to slabs, beams, joists, columns, walls and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

L. Install fittings for changes in direction and branch connections.

M. Install couplings according to manufacturer's printed instructions.

N. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wallboard partitions and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw and polished chrome-plated finish. Use split-casting escutcheons where required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips and chrome-plated finish.
5. Piping in Utility Areas: Cast-brass or stamped-steel with set-screw or spring clips.

O. Sleeves are not required for core drilled holes.

P. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.

Q. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

R. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. CPVC Pipe Sleeves: For pipes smaller than 6 inches.
    b. Steel Pipe Sleeves: For pipes smaller than 6 inches.
    c. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger, penetrating gypsum-board partitions.
    d. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
    e. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.

S. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeve and mechanical sleeve seals. Size sleeve for 1 inch annular clear space between pipe and sleeve for installation of mechanical seals.

1. Install steel pipe for sleeves smaller than 6 inches.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger.
3. Assemble and install mechanical seals according to manufacturer's printed instructions.

T. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

U. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

V. Verify final equipment locations for roughing-in.

W. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

X. Piping Joint Construction: Joint pipe and fittings as follows and as specifically required in individual piping system specification Sections.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS "Soldering Manual", "The Soldering of Pipe and Tube".
4. Brazed Joints: Construct joints according to AWS "Brazing Manual", "Pipe and Tube".
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

    a. Note the internal length of threads in fittings or valve ends and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

Y. Welded Joints: Construct joints according to AWS "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to "Quality Assurance" article.

Z. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

AA. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2 inches or smaller threaded pipe connection.
2. Install flanges, in piping 2 1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials or dissimilar metals.
4. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom, where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.03 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel".

3.04 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.05 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.06 DRIP PANS

A. Locate drip pans under piping passing over or within 3 feet horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, and weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1-inch drain line to drain connection and run to nearest plumbing drain or elsewhere as indicated. Provide Leak Detection

Alarm Floodmaster RS097. Provide power to unit.

3.07 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations in concrete, in wood or on structural steel for proper piping support. Space attachments within maximum piping span length indicated. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed, fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.08 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Install hangers and supports of same type and style for grouped piping runs.

C. Support fire water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

E. Provisions for movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe slopes: Install hangers and supports to provide indicated pipe slopes.

F. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.09 SHIELDS AND SADDLES FOR INSULATED PIPING

A. 4" and below use 16 gauge x 12 inch long shield with oversized hanger outside insulation.

B. 6" and above use hardwood protection saddle with 16 gauge x 18 inch long shield with oversized hanger outside insulation.

C. 6" and above use steel protection saddle. Fill void between shield and pipe with insulation. Cover with vapor barrier. Protect barrier with 16 gauge x 18 inch long shield with oversized hanger outside assembly.

3.10 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.11 FLASHINGS

A. Manufacturer's recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of sheet metal being installed.

B. Coat back side of metal flashings where in contact with concrete and other cementitious substrates, by painting surface in area of contact with heavy application of bituminous coating, or by other permanent separation as recommended by manufacturer of metal.

C. On vertical surfaces, lap flashings minimum of 3".

D. On sloping surfaces, for slopes of not less than 6" in 12", lap unsealed flashings minimum of 6".

E. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges minimum of 6" for embedment.

3.12 FIRE STOPPING

A. Provide UL listed and tested firestopping material, silicone elastomer specifically formulated for use in horizontal and vertical applications. The material shall possess intumescent characteristics, and upon exposure to heat above 250 degrees F. shall expand to not less than five times its original volume to form a fireproof envelope UL rated for 2- and 3-hours protection, when applied in accordance with the manufacturer's recommendation.

B. See section 220680 for additional fire stopping requirements.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220553 – PLUMBING IDENTIFICATION SYSTEMS

PART 1 – GENERAL

1.01 GENERAL

A. Provide labels for all new pipes including hot water, hot water return, cold water, sanitary drain, storm drain, vent, gas and acid waste piping. Install identifying tags on all valves.

PART 2 – PRODUCTS

2.01 EQUIPMENT LABELS

A. Small: Labels shall be adhesive backed plastic tape with embossed letters in contrasting color. Tape shall be 3/8” wide.

B. Large: Labels shall be adhesive backed plastic tape with embossed letters in contrasting color.

C. Make: Seton Name Plate Corporation.

2.02 PIPING MARKERS

A. Pipe markers shall be snap-on type indicating pipe contents and direction of flow on a color coded background conforming to American National Standards Institute (ANSI) Standard A13.1. Pipe diameter less than 2” and smaller shall be snap-on type. Pipe diameter greater than 2” shall be stick-on type.

1. Hot water – green with white lettering.
2. Cold water – green with white lettering.
3. Sanitary Drain and Vent – green with white lettering.
4. Storm Drain – green with white lettering.
5. Gas – yellow with black lettering.
6. Acid Waste – black with orange lettering.

B. Make: Seton Name Plate Corporation – Setmark, or equal by Dover, Brady.

2.03 VALVE TAGS

A. Tags: Tags shall be 1 3/4” x 3 1/2” laminated with two 0.020” thick plastic sheets with matte finish and with a brass eyelet in the corner. Typed information shall include appropriate alphanumeric code (prefixed with the letter “P”), system designation, the fluid in the pipe, and size and function of the valve.

B. Make: Dover Enterprises, Syracuse, New York or approved equal by Seton Name Plate Company.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish; including valve tags in finished mechanical spaces, install identification

after completion of covering and painting.

3.02 EQUIPMENT

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Meters, gauges, thermometers and similar units.
2. Fuel-burning units including water heaters.
3. Pumps and similar motor-driven units.
4. Storage tanks and pressure vessels.
5. Strainers, filters, humidifiers, water treatment systems and similar equipment.

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'–0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.03 PIPING

A. After piping has been painted or insulated, apply pipe labels as specified above.

B. Space labels on 15' centers in mechanical rooms, space at 25' centers elsewhere and at each side of partitions and interior walls. Also, at each branch and riser take off and adjacent to each valve (except at fixtures and equipment).

3.04 VALVES IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Provide valve tag chart, framed and securely fastened to the wall, using anchors and fasteners, where directed by owner.

C. Submit list of valve tags, including wording, for approval **BEFORE** ordering.

3.05 ADDITIONAL INFORMATION

A. For additional information see Specification Section 220300 – Plumbing Basic Materials & Methods.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220555 – ACCESS TO PLUMBING WORK

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Access doors in walls and ceilings.

1.02 SUBMITTALS

A. Product data: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.

1.03 QUALITY ASSURANCE

A. Fire resistance ratings: Where fire resistance rating is required for construction penetrated by access units, provide UL listed and labeled units, except for units which are smaller than minimum requirements.

PART 2 - PRODUCTS

2.01 ACCESS DOORS

A. Where walls and ceilings must be penetrated for access to mechanical work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

B. Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth, 16-gauge frames and 14-gauge flush panel doors, 175 degree swing with concealed spring hinges, flush screwdriver-operated cam locks, factory applied rust-inhibitive prime coat paint finish.

C. Available manufacturers:

1. Milcor Div., Inryco Inc.
2. Smith (Jay R.) Mfg. Co.
3. Zurn Industries, Inc.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with manufacturer's instructions for installation of access doors.

B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

D. Remove or replace panels or frames which are warped, bowed, or otherwise damaged.

E. Paint access doors to match surrounding surfaces.

F. In wet and damp locations provide stainless steel doors.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220680 – FIRE STOPPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in/ joints between fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested fire stop systems shall be used in specific locations as follows:

1. Penetrations for the passage of cable, conduit, piping, through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

B. Openings and penetrations in fire-rated partitions or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 220300 – Plumbing Basic Materials and Methods
2. Section 220719 – Plumbing Insulation

1.05 REFERENCES

A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Fire stop Devices (XHJI)
b. Fire Resistance Ratings (BXUV)
c. Through-Penetration Fire stop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)

2. Alternate “Omega Point Laboratories Directory” (updated annually)

C. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems” (July 1998.)

D. Test Requirements: ASTM E 1966-01, “Standard test method for Fire Resistive Joint Systems”

E. Inspection Requirements: ASTM E 2174 – 01, “Standard Practice for On-site Inspection of Installed Fire Stops.”

F. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

G. ASTM E-84-01, Standard Test Method for Surface Burning Characteristics of Building Materials.

H. All major building codes: ICBO, SBCCI, BOCA, and IBC.

I. NFPA 101 - Life Safety Code

J. NFPA 70 - National Electric Code

1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) and joint systems (XHBN) listed in Volume 2A of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma (or equal) 800-879-8000

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
   a. Add Aerator adaptor when used in conjunction with aerator (“sovent”) system.

2. Hilti CP 681 Tub Box Kit for use with tub installations.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 604 Self-leveling Firestop Sealant
3. Hilti CP 620 Fire Foam
4. Hilti CP 606 Flexible Firestop Sealant
5. Hilti CP 601s Elastomeric Firestop Sealant

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601s Elastomeric Firestop Sealant
2. Hilti CP 606 Flexible Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant

E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti CP 672 Speed Spray
2. Hilti CP 601s Elastomeric Firestop Sealant
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CP 604 Self-leveling Firestop Sealant

F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti CP 677 Speed Plugs
2. Hilti CP 767 Speed Strips

G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant

H. Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire stop Sealant
2. Hilti CP 618 Fire stop Putty Stick
3. Hilti CP 620 Fire Foam
4. Hilti CP 601s Elastomeric Fire stop Sealant
5. Hilti CP 606 Flexible Fire stop Sealant

I. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti CP 618 Fire stop Putty Stick

J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti CP 617 Fire stop Putty Pad

K. Fire stop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 Fire stop Collar
2. Hilti CP 643 Fire stop Collar
3. Hilti CP 645 Wrap Strips

L. Materials used for complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti CP 637 Trowelable Fire stop Compound
2. Hilti FS 657 FIRE BLOCK
3. Hilti CP 620 Fire Foam

M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK

N. Provide a fire stop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

O. Provide a fire stop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which fire stop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place fire- stop devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install fire stop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities, and engineer.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing fire stop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess fire stop materials and soiling as work progresses.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220719 – PLUMBING INSULATION

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of plumbing insulation work required by this section is indicated on Drawings and by requirements of this section.

B. Work includes thermal insulation for the following:

1. Domestic cold water piping.

2. Domestic hot water and hot water circulating piping.

3. Domestic tempered water piping.

4. Storm water drainage piping.

5. Roof drain bodies.

1.02 QUALITY ASSURANCE

A. Fire Hazard Classification: In accordance with ASTM E-84, NFPA 255 and UL 723, for insulation systems, including insulation, adhesives and coverings, not to exceed the following:

1. Flame spread 25.

2. Fuel contributed 50.

3. Smoke developed 50.

1.03 SUBMITTALS

A. Product Data: Submit manufacturers specification sheets, installation instructions, fire and smoke ratings. Submit schedule matching insulation type to mechanical systems and equipment.

1.04 INSULATION THICKNESS

A. Insulate domestic hot water supply, tempered water, and hot water recirculating piping with insulation thickness of fiberglass piping insulation as shown below, ASTM C 547 Class 1, with All Service Jacket.

B. Insulate domestic cold water Branches and Mains with insulation thickness as shown below of fiberglass piping insulation, ASTM C 547 Class 1.

C. Insulate storm water piping and roof drains with 1” insulation thickness of fiberglass insulation, ASTM C 547 Class 1.

D. Insulate condensate drain to HVAC units with 1” fiberglass insulation.

To Meet or Exceed Energy Conservation Construction Code of the State of New York

THICKNESS TABLE

	IPS 1-1/4" & Below	IPS 1-1/2" to 4"	IPS Above 4"
Hot Water	1"	1-1/2"	1-1/2"
Hot Water Ret.	1"	1-1/2"	N/A
Cold Water	1"	1"	1"
Storm	1"	1"	1"

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet installation, remove from project site.

PART 2 - PRODUCTS

2.01 DOMESTIC COLD WATER, HOT WATER, TEMPERED, AND HOT WATER CIRCULATING PIPING

A. Scope: Insulate all mains, branches, fittings, flanges and valves including those in ceiling spaces, pipe chases or spaces. Terminate insulation at the fixture supply stops. Insulate equipment connections to the equipment stop.

B. Type:

1. Pre-formed sectional type nominal 3# density glass fiber in standard 3' long sections tightly butted together. K factor (Thermal conductivity) of 0.23 at 750 mean. Make: Mansville, Owens-Corning, or Knauf.

C. Finish:

1. Main mechanical room piping and exposed risers and runouts in finished rooms: Factory-applied All Service Jacket with self-sealing laps.

2. Valves, fittings and flanges: Equal thickness of fiberglass insulation with Zeston fittings covers or equal by Ham-Fab, Mansville.

2.02 STORM WATER PIPING – ABOVE GROUND

A. Scope: Insulate all horizontal piping above ground including underside of roof drain bodies and all fittings.

B. Type: Pipe insulation shall be preformed sectional type nominal 3 pound density glass fiber in standard 3 foot long sections with a K factor of 0.23 at 75 mean and factory applied All Service Jackets. Seal joints with 3" All Service Jacket.

C. Fittings & Drain Bodies: Insulate all fittings, hubs, flange and Drain bodies with fiberglass pre-moulded fitting insulation or with 1" resilient fiberglass blanket. (3/4) pcf density minimum) wrapped around the fitting or drain body, tied down with wire or jute. Compress blanket 50% in installation.

Coat each fitting or drain body with two 1/8” coats of vapor barrier mastic reinforced with glass fabric extending 2” onto adjacent pipes.

2.03 METAL JACKETED PIPE INSULATION

A. Scope: Pipe exposed to weather or physical abuse shall be insulated with .016” aluminum jacket over fiberglass insulation of the specified thickness. Sections shall be made in 36” lengths.

B. Fire and smoke Hazard Classification shall not exceed flame spread index of 25 or less and smoke developed index of 50 or less as tested by ASTM E-84, NFPA 255 or UL 723.

C. Manville Micro-Lok 650ML.

2.04 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Class 2.

B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type I, Class B-4.

C. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer’s option, except as otherwise indicated.

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Apply insulation in accordance with the Schedule of Insulation on the Contract Specifications.

B. Use only insulation and finish materials including adhesives, cements, and mastics which conform to the requirements of all local codes and ordinances.

C. Fire resistant adhesive is highly flammable in liquid form. Eliminate welding, smoking, or other sources of ignition during application.

D. Apply insulation after all piping pressure tests, as described in Piping Installation Procedure, have been completed.

E. Clean surfaces of loose scale, dirt, oil, and other foreign matter and dry prior to insulating.

1. Detail for space @ blowdown
2. Detail for pipe @ insulation penetrating wall.

F. Apply insulation to completely cover piping surface. Do not insulate over weld certification stamps.

G. "Exposed" as used in this section means exposed to view. "Concealed" means concealed to view such as in furred chases or above suspended ceiling. Penthouse and equipment rooms are considered exposed locations.

H. Fill surface imperfections in the insulation such as chipped edges, small joints or cracks, and small voids or holes with appropriate insulation material and smooth with skim coat of hydraulic-setting insulating cement. Vapor barriers shall be continuous and unbroken at hanger installations.

I. Fit inside diameter of insulation sections or segments to outside curvature of pipe or previous insulation layer.

J. Where standard insulation shapes are not available, cut, score, or miter segments of appropriate block to fit contour of pipe. Stagger joints of adjoining segments. Fit insulation carefully and secure with No. 20 gage galvanized annealed steel wire. Finish with a smoothing coat of hydraulic-setting insulating cement.

K. Insulate valves, strainer, fittings, and flanges with identical material, density, thickness, and surface finish as the piping insulation. All edges shall be filled with filler and finished with a smoothing coat of hydraulic-setting insulating cement.

L. Insulate the entire surface of fittings and strainers. Insulate valves up to and including bonnets, unless authorized otherwise by Project Engineer. Do not cover removable valve bonnets.

M. Insulate strainers to permit removal of the basket without disturbing the insulation of the strainer body. Strainer covers shall be molded and taped to upper section of insulation.

N. Bevel the ends of pipe insulation adjacent to flanges to permit bolt removal. Provide a collar of sectional block insulation over the flanges and extend a minimum of 2 inches over the adjacent pipe insulation. Fasten with staples to permit easy removal. Prior to applying collar fill annular spaces with loose insulation.

O. Insulate all piping through sleeves.

P. Where pipelines pass through masonry walls or floors, completely fill the space between outside of pipe or insulation and the inside of the sleeve or framed opening with fibrous mineral wool or fiberglass pipe insulation.

Q. When it is unavoidable and hangers for cold lines must be installed directly on the pipe, insulate and finish the entire hanger and the rod for a length of not less than 12 inches above the pipe.

R. Apply insulation to completely cover metal surfaces.

S. Cut, score, or miter insulation to fit shape and contour of equipment. Where surfaces are flat, cylindrical, or regularly curved, use premolded blocks or segments.

T. Where required, provide permanently fastened angles or plates to support insulation.

U. Apply insulation on cover plates, heads and access openings as separate sections, with insulation cut back for access to boltheads and other fasteners.

V. Do not insulate over nameplates. Cut back insulation and line the insulation edges with 24 gage galvanized steel.

W. Surface Finish.

1. Apply surface finish to present a tight, smooth appearance.
2. Do not apply sealant or cement until all previous applications of cement and adhesives have thoroughly dried.
3. Extend surface finish to protect all insulation surfaces. Prevent raw edges or ends of insulation from being exposed.

3.02 INSTALLATION OF PIPING INSULATION

A. Apply to pipes with side and end joints butted tightly per manufacturer's directions.

B. Where joints in insulation occur, and at hangers, take extra precautions to seal the vapor barrier with adhesive BF 95-44 so that no moisture penetration will occur. Notify Engineer when insulation is complete so he may make inspection before walls are closed in or ceilings applied.

C. Where fiberglass insulation is exposed in an occupied room, apply pre-sized glass cloth vapor barrier jacket in same manner using same type of adhesive (or use ASI/SSL).

D. Repair all breaks in the jacket with 4" wide strip of vapor barrier jackets (FRGC or SSL as required) applied smoothly and securely. When applying adhesive at temperature below 750F, use staples with an additional brush coat of adhesive over the exterior of the staples.

E. Adhere 4" wide strips of jacket material smoothly and securely over all end joints with vapor barrier adhesive as above to insure a continuous vapor barrier.

F. Apply insulation on all cold surfaces where vapor barrier jackets are used with a continuous, unbroken vapor seal. Insulate and vapor seal hangers, supports, anchors, etc., that are securely directed to cold surfaces to prevent condensation.

3.03 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature)

1. Application Requirements: Insulate the following cold equipment:

   a. Domestic Hot water expansion tanks

2. Insulate each item of equipment specified above with fiberglass: 2" thick.

B. Hot Equipment (Above Ambient Temperature)

1. Application Requirements: Insulate the following hot equipment.

   a. Hot water storage tanks
   b. Water heaters (not insulated by manufacturer)

2. Insulate each item of equipment specified above with fiberglass: 2" thick.

3.04 SUPPORT OF INSULATED PIPE LINES

A. Scope: Install inserts at each hanger or support for all water lines for sizes 1-1/2" and up, or 16-gauge electro-galvanized carbon steel shields may be used in lieu of inserts. Install supporting devices on insulated lines with hangers with insulation shields.

B. Inserts:

1. Inserts between the pipe and pipe hangers shall consist rigid pipe insulation of equal thickness to the adjoining fiberglass insulation and shall be provided with vapor barrier where required.

2. Insulation inserts shall not be less than the following lengths:

   1-1/2" to 2-1/2" pipe size, use 6" length
   3" to 6" pipe size, use 9" length

C. Supporting Devices: Use cork stoppers, short lengths of wood dowels or wood blocks of the same thickness as insulation. Curve the support device surfaces to match the curve of the metal shield. Metal shields are provided with the hanger.

3.05 ADHESIVES, MASTIC, AND COATINGS

A. Apply adhesives, mastic and coatings specified at the manufacturer's recommended coverage per gallon.

3.06 EXPOSED RISERS AND RUNOUTS

A. Finish exposed risers and runouts in occupied rooms with ALL SERVICE JACKET.

B. Occupied areas mean all areas except ceiling spaces, crawl spaces and closed off pipe spaces or chases.

3.07 EXISTING INSULATION REPAIR

A. Repair damaged sections of existing mechanical insulation damaged during this construction period. Use insulation of the same thickness as existing insulation. Install new jacket lapping and seal over existing.

3.08 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

C. Surface Finish: No surface finish required.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 220801 – PLUMBING TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provision of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of testing, adjusting and balancing work is indicated by requirements of this section, and also by drawings and schedules.

B. Component types of testing, adjusting and balancing specified in this section includes the following:

1. Rough sanitary and storm piping.
2. Water supply system.
3. Gas system – Refer to Specification Section 226310.

1.03 QUALITY ASSURANCE

A. Installer - a firm with at least 3 years of successful testing, adjusting and balancing experience on projects with testing and balancing requirements similar to those required for this project.

1.04 REQUIREMENTS

A. No system shall be covered or concealed until tested, approved.

B. Pay for Permit and Inspection Fees required by Authority having jurisdiction.

C. Test in presence of Owner's Representative and Plumbing Inspector.

D. Prove tight for period stated or longer if required.

E. Tests may be made in sections.

1.05 CODES AND REQUIREMENTS

A. Comply with latest editions and applicable portions of International Plumbing Code, Local Plumbing Standards, New York State Building Code, especially Article 9, Plumbing Requirements and Plumbing Code.

B. Comply with applicable portions of Standards for Waste Treatment Works, New York State.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide test equipment and materials necessary for tests.

PART 3 – EXECUTION

3.01 GENERAL

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable.

B. Test, adjust and balance systems and components as indicated, in accordance with procedures outlined below and in applicable standards. Test which follows shall be considered minimum standards.

3.02 TESTS & INSPECTIONS

A. Rough Sanitary and Storm Piping.

1. Stop openings, fill with water to top of highest vent. Water shall hold constant for two (2) hours.
2. May be tested in sections using water pressure test.
3. Test pressure shall be equal to at least 10 ft. water column at all points.
4. Retest at least upper 10 ft. of next lower section.
5. Compliance with the Department of Health Lead in Water Regulation is located on Drawings.

B. Water Supply System.

1. Fill, subject to 125 psig hydrostatic pressure at lowest level for two (2) hours.
2. Fixtures shall not be connected into system during test.
3. After fixtures are connected, test system for two (2) hours, at 75 PSIG or prevailing water pressure, whichever is higher.
4. Regulate flow of water to each fixture.
5. Adjust balancing valves on hot water system.
6. Faucets, flush valves shall operate satisfactorily without waste of water, without objectionable noise.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 221000 – PLUMBING PIPING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of domestic water piping systems work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for domestic water piping systems include the following:

1. Domestic cold water piping.
2. Domestic hot water piping.
3. Domestic recirculating water piping.
4. Water hammer arresters.
5. Valves.
6. Pumps

C. All domestic water piping systems must comply with the “Lead-Free” Division 22 Specifications. The contractor shall provide the required submittals for all equipment that will be part of the system prior to the equipment installation, and confirm on the jobsite that the equipment adheres to “Lead-Free” regulations.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's data for domestic water piping systems, materials and products.

B. Submittals shall include but not be limited to the following:

1. Valves
2. Water hammer arresters
3. Piping
4. Pumps

1.03 QUALITY ASSURANCE

A. Plumbing Code: Comply with applicable portions of New York State Uniform Fire Protection and Building Code, Article 9, Plumbing Requirements, State sanitary code, Department of Health, Division Sanitary Engineering, Bureau of Public Water Supply, any local codes or regulations, and the International Plumbing Code and the International Energy Conservation Code.

B. All piping valves, hydrants, etc. shall comply with all ASME, ANSI, ASTM, AWWA and NFPA regulations that apply to the work.

C. Meters, backflow preventers, hydrants, etc. shall conform to local utility company regulations, ordinances and laws, and the International Plumbing Code (IPC).

D. Obtain all necessary approvals, certificates and arrange for all inspections required by local authorities having jurisdictions. Pay all fees.

E. Perform water sampling upon completion of all piping systems. Samples to be analyzed by a NYS Dept. of Health approved lab for bacteria as well as all other code required chemical / organic

analyses. The plumbing contractor will bear all costs associated with the testing procedures / reports. Test reports shall be included as part of the project closeout documents.

PART 2 – PRODUCTS
(All to comply with the 2020 IPC)

2.01 DOMESTIC WATER PIPING

A. Underground Water

1. 3" or larger: Class 52 ductile iron pipe per AWWA C151, with C104 cement lining, and asphaltic coating inside and out. Fittings shall be cast or ductile iron per AWWA C110, with push-on joints with four serrated silicon bronze wedges at each joint for electrical continuity. Underground type plastic line marker: Provide standard permanent bright colored, continuous-printed plastic tape, intended for direct burial service, not less than 6"wide X 4 mils thick, with lettering "WATER SERVICE".

2. 2" and smaller: Type 'K' copper soldered or brazed.

B. Domestic hot water, cold water and tempered water.

1. Type "L" copper, ASTM B88.
2. Make: Anaconda, or equal by Muller, Revere.
3. Fittings shall be wrought or cast solder type pressure fittings.
4. Chrome plated sponge cleanable brass, sch. 40 for exposed piping.

2.02 BALL VALVES

A. Description: Bronze body, ball valve with 600 PSI W.O.G. min. rating, teflon seats, stainless ball, blow-out proof stem, viton-o-ring sealed union, removable operating handle and solder ends. Bronze materials to be "no lead" type, in conformance with the latest edition of NSF 61. ANSI372.

2.03 INTERIOR HOSE BIBBS

A. 'No-Lead', Anti-siphon vacuum breaker wall faucet enclosed in a flush mounting wall box, ¾" male hose outlet, loose key opens box and faucet operator, chrome plated casting.

B. Manufacturer:

1. Josam or equivalent. Where indicated, install on cold water piping.

2.04 EXTERIOR WALL HYDRANTS

A. 'No lead', Automatic draining, freezeless wall hydrant with an anti-siphon vacuum breaker enclosed in a flush mounting wall box. Cast bronze, ¾" male hose outlet, non-freeze, "water" on cover, key handle, proper length galvanized wall sleeve, vacuum breaker, wall clamp, chrome finish.

B. Where indicated, install on cold water piping.

2.05 SWING CHECK VALVES

A. General: Construct pressure-containing parts as follows:

1. Bronze valves, 125 or 150 psi: ANSI/ASTM B 62. Bronze materials to be "no lead" type, in conformance with the latest edition of NSF 61. ANSI 372.

B. Construct valves with disk seating angle 40° to 45° unless composition disc is specified. Provide stop plug as renewable stop for disc hanger. Construct disc and hanger as separate parts, with disc free to rotate. Support hanger pins on both ends by removable side plugs.

C. Soldered ends 2" and smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc.

D. Flanged ends 2 1/2" and larger: Class 125, iron body bronze mounted, bolted cap, horizontal swing, cast iron disc.

E. Manufacturers:

1. Jenkins Bros., A Corp.
2. Kennedy Valve.
3. Lunkenheimer.
4. Stockham Valves and Fittings, Inc.

2.06 SPECIAL VALVES

A. Balance valve:

1. Bronze/Brass Ball valve with pressure readout ports, calibarated nameplate and memory stop. Bronze materials to be "no lead" type, in conformance with the latest edition of NSF 61.

2. Manufacturer: Bell & Gossett model CB, Watts

B. Trap Primer Valve:

1. 'No lead', Automatic, large port openings, activates on 10 psig pressure drop at 30-250 psig. Water release is factory set. Chrome plated finish.

2.07 THERMOMETERS AND GAGES

A. Water Pressure Gages: 0-150 psi range, aluminum or brass 4-1/2" case, 1/4" NPT connection. Glass enclosed dial with ¼" ball valve. 1 percent accuracy, ANSI B40.1, Grade A.

B. Glass Thermometers

1. General: Die cast aluminum, baked epoxy enamel finish, glass front, 9" long, adjustable joint, locking device. 1 percent accuracy, shock mounted. Copper plated steel or brass stem. Alcohol based thermometers to be used.

2. Range:
   a. Hot water: 30 to 240°F, 2°F divisions.
   b. Cold water: 30 to 180°F, 2°F divisions.

3. Thermometer wells: No Lead, Brass or stainless steel, 2" extension for insulated piping. Cap nut with chain fastened to thermometer well.

2.08 PLUMBING INSULATION

A. General: Comply with Division 22 Section "220719 – Plumbing Insulation".

2.09 UNIONS

A. Description: "No lead" Cast Brass with Solder Ends. Working pressure: 200 PSI W.O.G.

B. Manufacturer: Nibco, or equal by Mueller, Revere.

2.10 SOLDER AND FLUX

A. Solder shall be in solid wire form of Type II 95-5 tin antimony solder conforming to ASTM B-32, Grade 5A. Flux shall be a zinc chloride or a mixture of zinc and ammonium chlorides. Solders containing lead shall not be used. 96.5 – 3.5 and 95-5 tin/silver solders may be used.

2.11 SHOCK ARRESTER

A. Construction:

1. Type 1: Stainless steel body with stainless steel bellows, an air or argon gas cushion and with or without hydraulic displacement fluid.

2. Type 2: “No lead” Hard drawn copper body, polypropylene piston with EPDM O ring seal and brass NPT threaded connection.

3. Contractor may use either Type 1 or Type 2.

B. Code Compliance: Shock absorbers shall comply with the following codes:

1. P.D.I. – WH201 latest issue.
2. ASSE 1010 latest issue.

C. Manufacturer:
1. Type 1: J.R.Smith 5000 Series.
2. Type 2: Watts LF15M2 -DR Series

PART 3 – EXECUTION

3.01 INSTALLATION OF DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

A. General: Install the following in accordance with Division 22 Section 220300 – “Basic Materials and Methods".

1. Identification.
2. Piping specialties.
3. Supports, anchors and seals.

3.02 INSTALLATION OF PIPE, TUBE AND FITTINGS

A. General: Install in accordance with Division 22 Section 220300 – “Basic Materials and Methods".

B. Install in accordance with recognized industry practices, which will achieve permanently leak proof piping systems. Install each run with minimum joints and couplings. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ANSI B31 Code for pressure piping.

C. Hose faucets at low points. Cap with hose caps.

D. Carry headers for groups of fixtures full size through their length.

E. Swing joints as follows:

1. From water mains to risers.
2. From riser to branch connections to fixtures.
3. From riser to mains.

3.03 INSTALLATION OF SHOCK ARRESTORS

A. General: Upright position, locations and sizes indicated in accordance with PDI Standard WH-201.

3.04 INSTALLATION OF STRAINERS

A. General: Install full size of pipeline, in accordance with manufacturers installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.

B. Locate plate-type strainer in supply line ahead of the water meter.

3.05 INSTALLATION OF VALVES

A. General: Install where required for proper operation of piping and equipment, including all branch lines to isolate sections of piping. Locate to be accessible and separate support can be provided.

B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable.

C. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

D. Drain Valves: Each plumbing equipment item. Located to completely drain equipment for service or repair. Base of each riser, base of each rise or drop in piping system, at all low points, and where indicated or required to completely drain system. Provide hose caps on hose bibbs.

E. Check Valves: Horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

3.06 INSTALLATION OF SPECIAL VALVES

A. Balance Valves: Each hot water recirculating loop, and where indicated.

B. Trap Primer Valves: Install in upright, vertical position in a convenient cold water line where indicated for floor drain primer supply.

3.07 INSTALLATION OF THERMOMETERS AND GAGES

A. General: Install in accordance with manufacturer's instructions.

B. Locations: Where indicated on Drawings.

3.08 INSTALLATION OF PLUMBING INSULATION

A. Install in accordance with Division 22 Section "220719 – Plumbing Insulation ".

3.09 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Hot and cold water runouts of sizes indicated, no smaller than required by the Plumbing Code.

B. Mechanical Equipment Connections:

1. Connect hot and cold water piping system to plumbing equipment as indicated.
2. Comply with equipment manufacturer's installation instructions.
3. Provide shutoff valve and union for each connection.
4. Provide drain valve on drain connection.
5. Exposed piping shall be sch. 40 chrome plated brass, sponge cleanable surface.

3.10 WALL HYDRANT AND HOSE BIBB INSTALLATION

A. Wall hydrant: Install approximately 24” above finished grade or as noted on the plans. Install a stop and drain valve on each wall hydrant branch.

B. Hose Bibbs for toilet and finished rooms: In rooms where shown with lavatories, install approximately 18” above finished floor under lavatory where indicated. Elsewhere, install 36” above the finished floor where shown. Install stop on branch. Hose bibbs to be furnished with loose key handles.

3.11 WATER SYSTEM DISINFECTION

A. Scope: All newly installed lines carrying potable water and parts of existing systems which have been altered, extended or repaired prior to use.

B. Before any use of system is made for domestic purposes, disinfect by one of the following methods as specified in the New York State Uniform Fire Prevention and Building Code. All water samples are to be sent to / tested by a New York State Department of Health approved lab for bacteria analysis. All test results shall be sent to the engineer for review prior to placing the systems in service.

1. The system shall be filled with a water solution containing 50 parts per million of available chlorine and allowed to stand for 24 hours before flushing and returning to service.

2. The system shall be filled with a water solution containing 200 parts per million of available chlorine and allowed to stand one hour before flushing and returning to service.

3. For a potable water storage tank, where it is not practicable to disinfect by the foregoing methods, the entire interior of the tank shall be swabbed with a water solution containing 200 parts per million of available chlorine and allowed to stand for two hours before flushing and returning to service.

C. Contractor shall provide test kit for residual chlorine.

D. After contact period flush system with clear water until system tests no more than 0.2 PPM residual chlorine.

3.12 DOMESTIC WATER SYSTEM TEST

A. Test in accordance with the requirements of Section 220801 – “Plumbing, Testing, Adjusting and Balancing.”

3.13 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bib, or faucet installed.

3.14 LEAD TESTING REQUIREMENTS

A. Following the completion of the P.C. work scope, the owner shall have the water conditions tested for lead containments by a third-party testing firm to regulation 67.4 of the Department of Health regulations as part of Section 1417 of the Federal Safe Water Act to determine “Lead-Free” compliance and SED guidelines of less then 15 parts per billion.

B. If the system does not comply with Sub-Part Regulation 67.4 of the DOH Section 1417 of the Federal Safe Water Act, the P.C. shall provide replacements at no additional cost, to then repeat the installation and testing requirements. The P.C. shall absorb the fee for the first lead testing procedure as well as the following confirmation procedures at no additional cost to the owner.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 221316 – SANITARY WASTE AND VENT PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of soil, waste and vent piping system work, is indicated on drawings and schedules, and by requirements of this section.

B. Applications for soil, waste and vent piping systems include the following:

1. Above ground soil, waste and vent piping within buildings including soil stacks, vent stacks, horizontal branches, traps, and connections to fixtures and drains.

2. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, terminating at connection to sanitary sewer, 5’-0” from building wall, or where shown on drawing. Coordinate with site contractor.

C. Trenching and backfilling is required in conjunction with underground and building drain piping is specified in applicable Division 22 sections, and is included as work of this section.

1.03 QUALITY ASSURANCE

A. Plumbing code compliance - comply with applicable portions of New York State Uniform Fire Protection and Building Code, especially Article 9, Plumbing Requirements, State Sanitary Code, Department of Health, Division Sanitary Engineering, Bureau of Public Water Supply, any local codes or regulations that apply pertaining to plumbing materials, and the 2020 IPC especially Chapter 7.

B. ANSI compliance - comply with applicable American National Standards pertaining to products and installation of soil and waste piping systems.

C. PDI compliance - comply with applicable Plumbing and Drainage Institute Standards pertaining to products and installation of soil and waste piping systems.

1.04 SUBMITTALS

A. Product data - submit manufacturer's data for soil and waste piping systems materials and products on the following:

1. Pipe and Couplings
2. Clean outs
3. Floor drains

B. Acceptable Manufacturers

1. Floor Drains
   a. Jay R. Smith

b. Josam
c. Zurn
d. Watts

2. Couplings for no-hub pipe
   a. Anaco
   b. Tyler

3. Soil Pipe
   a. Eastern Foundry
   b. Tyler Pipe
   c. Charlotte Pipe

PART 2 – PRODUCTS
(All to comply with the 2020 IPC)

2.01 SOIL AND WASTE PIPING MATERIALS AND PRODUCTS

A. General - provide piping materials and factory fabricated piping products of sizes, types, pressure ratings and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections, provide fittings of materials which match pipe materials used in soil and waste piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.02 BASIC IDENTIFICATION

A. General - provide identification complying with Specification Section 220553, in accordance with the following listing:

1. Above ground soil, waste and vent piping - pipe markers.
2. Underground building drain piping - underground type plastic line markers.

2.03 PIPE

A. Below Ground:
   1. Service weight cast iron with push-on gaskets, hub and spigot. Compression Gaskets shall conform to the requirements of ASTM Standard C564-14 and CISPI310.

B. Above Ground:
   1. Service weight C.I. soil pipe and fittings with no-hub joints. Make: Tyler pipe or equal by Eastern Foundry Co. Anaheim Foundry Co.
   2. Copper drainage tubing, type DWV, shall not be used on site.
   3. Exposed: Sch. 40 chrome plated brass, threaded, sponge cleanable.

2.04 COUPLINGS FOR NO-HUB PIPE

A. Description: Type 304 stainless steel shield and 3/8” slot head 304 stainless steel screws. All other component metal parts shall be 304 stainless steel. The coupling sealing gasket shall be made of Neoprene as the sole elastomer. A cast iron coupling may be used. Do not use under ground. Coupling shall meet or exceed CISPE Standard 310.

B. Manufacturer: Anaheim Co., Tyler Pipe.

2.05 BASIC PIPING SPECIALTIES

A. General - provide piping specialties complying with Division 22 – Section 220300 Basic Materials and Methods section, in accordance with the following listing:

1. Pipe escutcheons.
2. Mechanical sleeve seals.
3. Pipe sleeves.

2.06 BASIC SUPPORTS AND ANCHORS

A. General - provide supports, anchors and seals complying with Division 22 – Section 220300 Basic Materials and Methods section "Supports and Anchors".

2.07 CLEANOUTS

A. General

1. Units shall meet all design parameters shown on the drawings.
2. Units shall be complete with all design features and accessories necessary to provide a coordinated installation (such as carpet markers, tile recesses, etc.).
3. Units shall be of the following sizes:

    a. Line size for piping to 4”.
    b. 4” for piping from 5” to 8”.
    c. 6” for piping 10” and larger.

4. Location:

    a. At each bend of more than 45 degrees.
    b. At bottom of soil or waste stacks and rainwater leaders.
    c. At 50’ intervals or less on horizontal pipe lines 4” or smaller.
    d. At 50’intervals or less horizontal pipe lines 5” or larger.
    e. At exit of sanitary and storm drains from building.
    f. Wherever shown on the drawings.
    g. At the end of each branch line serving more than two fixtures.

5. Placement: must be located where they will be accessible. Check general construction drawings for location of lockers or other equipment which may prevent access.

B. Cleanout Types

1. Deck Plate Cleanout:

    a. Adjustable cast iron floor cleanout with inside caulk outlet, adjustable ABS housing, clamp device, internal tapered bronze cleanout plug, secured round scoriated nickel alloy cover plate. Jay R. Smith Figure 4020.

2. Wall Plate Cleanout:

    a. Exposed installation: Cast iron ‘T’ branch cleanout tee with bronze tapered plug. Jay R. Smith Fig. 4510
    b. Concealed installation behind plaster, dry or masonry walls: Provide cleanout tee with bronze plug tapped for center screw similar to exposed installation with polished vandalproof stainless steel access plate.

C. Cleanout:

1. Cast iron cleanout with straight body for caulking into soil pipe hub and fitted with bronze plug countersunk or raised head as required.

D. Exterior Cleanout:

1. Round coated cast iron access frame, heavy duty scoriated (vandalproof), secured cover. Coated cast iron cleanout ferrule with inside caulk connection and recessed tapered thread bronze plug.

2.08 FLOOR DRAINS

A. Drains and traps shall be same size as waste pipes. Provide clamping devices for drain flashing. Provide P-trap in outlet from each drain, or as shown on drawings.

B. Drain bodies to be cast iron.

C. Floor drains shall be by Jay R. Smith, Zurn, Watts or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION OF BASIC IDENTIFICATION

A. General - install plumbing identification in accordance with Specification Section 220553.

3.02 INSTALLATION OF SOIL WASTE AND VENT PIPING

A. General - install soil and waste piping in accordance with Division 22 – Section 220300 Basic Materials and Methods section "Pipe, Tube and Fittings" and with Plumbing Code having jurisdiction.

B. Solder joints use Type 1 solder.

C. Insulate vent piping within three feet of passage through roof.

3.03 INSTALLATION DRAINAGE PIPING - SANITARY

A. Changes in direction long sweep bends or 1/8 and/or 1/16 bends.

B. Connections of branches to mains with "Y" fittings and 1/8 and/or 1/16 bends.

C. All connections of horizontal into vertical piping with long turn sanitary "T-Y's".

D. Grade the "horizontal" piping 1/4" per foot, minimum for 2 1/2” or less, 1/8” per foot minimum for 3” and larger.

3.04 TURNS AND OFFSETS

A. Turns:

1. From vertical to horizontal:
   a. Less than 3”: Use long sweep or extra-long turn elbow.
   b. 3” and larger: Use short sweep or 90° short turn fittings.
   c. Horizontal piping: Use 45° wyes, long sweeps: 1/4, 1/6, 1/8 and 1/16 bends or any

combination of same.
d. For vents in any direction; Use quarter bends or 90° short turn fittings.

B. Offsets:

1. Make offsets at no less than 45° angle to the horizontal in the following cases:

a. Offsets in stack vent portion of soil and waste stacks (above the highest fixture drainage connection).
b. Offset in vent stacks.
c. Grade the “horizontal” piping 1/4" per foot.
d. Connect all plumbing fixtures into sanitary house drain. No case shall soil or waste pass through more than one trap before entering house drain.

3.05 INSTALLATION OF VENT PIPING

A. Provide vents shown and required by Plumbing Code.

B. Grade vents to discharge water of condensation.

C. Make offsets at 45 degree angle.

D. Connect upper ends of drainage lines to vent system or extend through roof without decreasing size.

E. Arrange vents and connections except wet vents, so not to carry drainage.

F. Connect bottom to drains so drainage will wash out rust and scale.

G. Extend vents above floor line to not less than 6" above flood rim of highest fixture before running horizontally.

H. Terminate vents 18 inches above roof line.

I. Increase pipes smaller than 3" to 3" from 18 inches below roof to terminus, using standard length tapered increasers.

3.06 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division 22 – Section 220300 Basic Materials and Methods section.

3.07 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports, anchors and seals in accordance with Division 22 – Section 220300 Basic Materials and Methods section.

3.08 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts - install in sanitary above ground piping and sanitary building drain piping as indicated, as required by Plumbing Code, and at each change in direction of piping greater than 45 degrees, at minimum intervals of 50' for piping 4" and smaller and 50' for larger piping, and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping.

B. Flashing flanges - install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

3.09 INSTALLATION OF FLOOR DRAINS

A. General - install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.

C. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

E. Position drains so that they are accessible and easy to maintain.

3.10 FLASHING

A. General

1. Flash openings with 6 lb. copper flashing.
2. Make watertight, allow for expansion and contraction.

B. Vent pipes

1. Extend not less than 12" from base of pipe.
2. Turn flashing over edge on cast iron; extend into same one (1) inch.
3. Ream coupling screw down over flashing at least one (1) inch screwed pipe.
4. Copper flashing assembly acceptable.

C. Waterproof pipes through waterproof walls or floors: See details on drawings.

3.11 EQUIPMENT CONNECTIONS

A. Piping runouts to fixtures - provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by Plumbing Code. Traps and tailpieces shall be chrome plated brass. Waste stubs out of wall (exposed) shall be sch. 40 threaded chrome plated brass. All exposed surfaces shall be sponge cleanable.

3.12 INSPECTION AND TEST

A. New drainage piping shall be subjected to hydrostatic pressure test, see requirements in Section 220801, “Plumbing Testing, Adjusting and Balancing”.

3.13 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with construction materials and debris and to prevent damage from traffic and construction work.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 221400 – STORM WATER PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of storm water piping work is indicated on drawings, and by requirements of this section.

B. Applications for storm water piping include the following:

1. Conductor piping from roof drains to storm building drain.

2. Storm building drain piping from conductor piping and area drains to storm sewer.

C. Insulation for storm water piping is specified in Specification Section 220719, and is included as work of this section.

D. Trenching and backfill required in conjunction with storm building drain piping is specified in specification section 220000, and is included as work of this section.

1.03 QUALITY ASSURANCE

A. Plumbing code compliance - comply with applicable portions of Plumbing Standards, New York State Uniform Fire Protection and Building Code, especially Article 9, Plumbing Requirements, State Sanitary Code, Department of Health, Division Sanitary Engineering, Bureau of Public Water Supply, any local codes or regulations that apply pertaining to plumbing materials, and 2020 IPC.

B. ANSI compliance - comply with applicable American National Standards pertaining to products and installation of storm water piping systems.

1.04 SUBMITTALS

A. Product data - submit manufacturer's data for storm water piping systems materials and products on the following:

1. Cleanouts
2. Catch Basins

B. Acceptable Manufacturers

1. Roof Drains

a. By General Contractor.

2. Couplings for no-hub pipe

a. Anaco 'Husky'
b. Clamp-All

c. MG Coupling

3. Soil Pipe

   a. Eastern Foundry
   b. Tyler Pipe
   c. Charlotte Pipe

4. Catch Basins

   a. Jay R. Smith
   b. Josam
   c. Zurn

PART 2 – PRODUCTS
(All to comply with the 2020 IPC)

2.01 STORM WATER PIPING MATERIALS AND PRODUCTS

A. General - provide piping materials and factory fabricated piping products of sizes, types, pressure ratings and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections, provide fittings of materials which match pipe materials used in storm water piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.02 BASIC IDENTIFICATION

A. General - provide identification complying with specifications section 220553 plumbing identification systems, in accordance with the following listing:

1. Above ground conductor piping - plastic pipe markers.
2. Underground building drain piping - underground type plastic line markers.

2.03 PIPE

A. Above Ground Piping within building:

1. Hubless cast-iron pipe
   a. Pipe class – service weight
   b. Fittings – hubless cast-iron soil pipe fittings, hubless joints.

2. Galvanized Steel Pipe
   a. Pipe Weight - Schedule 40
   b. Fittings - Class 125 galvanized cast-iron drainage pattern screwed joints.
   c. Fittings – mechanical grooved type.

B. Below Ground:

1. Service weight cast iron with push-on gaskets.

2. Fittings – cast-iron, hub-and-spigot soil pipe fittings with neoprene gaskets. Gaskets shall conform to the requirements of ASTM Standard C-564.

2.04 COUPLINGS FOR NO-HUB PIPE

A. Description: A heavy duty 24 gauge type 304 stainless steel shield and 3/8" slot head 304 stainless steel screws. All other component metal parts shall be 304 stainless steel. The coupling sealing gasket shall be made of Neoprene as the sole elastomer. Coupling shall comply with CISPI 310. Do not use under ground. Torque to 80 in-lb. Joints shall be good for a minimum of 15 psi. Above these pressures, all piping shall be properly restrained at each joint.

B. Manufactuer: Anaco, Tyler, Clamp-All.

2.05 BASIC PIPING SPECIALTIES

A. General – provide piping specialties complying with Division 22 Section 220300 – Basic Materials and Methods section "Piping Specialties", in accordance with the following listing:

1. Pipe escutcheons
2. Mechanical sleeve seals
3. Drip pans
4. Pipe sleeves
5. Sleeve seals

2.06 BASIC SUPPORTS, ANCHORS AND SEALS

A. General - provide supports, anchors and seals complying with Division 22 Section 220300 – Basic Materials and Methods section “Supports, Anchors and Seals”.

2.07 CLEANOUTS

A. General

1. Units shall meet all design parameters shown on the drawings.

2. Units shall be complete with all design features and accessories necessary to provide a coordinated installation (such as carpet markers, tile recesses, etc.).

3. Units shall be of the following sizes:

   a. Line size for piping to 4”.
   b. 4” for piping from 5” and larger

4. Location:

   a. At each bend of more than 45 degrees.
   b. At bottom of soil or waste stacks and storm water leaders.
   c. At 50’ intervals or less on horizontal pipe lines 4” or smaller.
   d. At 100’ intervals or less on horizontal pipe lines 5” or larger.
   e. At exit of sanitary and storm drains from building.
   f. Wherever shown on the drawings.
   g. At the end of each branch line serving more that two fixtures.

5. Placement: must be located where they will be accessible. Check general construction drawings for location of lockers or other equipment which may prevent access.

B. Cleanout Types

1. Deck Plate Cleanout, CODP:

a. Adjustable cast iron floor cleanout with inside caulk outlet, adjustable ABS housing, clamp device, internal tapered bronze cleanout plug, secured round scoriated nickel alloy cover plate. Jay R. Smith Figure 4020.

2. Wall Plate Cleanout, COWP:

a. Exposed installation: Cast iron 'T' branch cleanout tee with bronze tapered plug. Jay R. Smith Fig. 4510.
b. Concealed installation behind plaster, dry or masonry walls: Provide cleanout tee with bronze plug tapped for center screw similar to exposed installation with polished vandalproof stainless steel access plate. Jay R. Smith Fig. 4530

3. Cleanout, CO:

a. Cast iron cleanout with straight body for caulking into soil pipe hub and fitted with bronze plug countersunk or raised head as required. Jay R. Smith Fig. 4280.

4. Exterior Cleanout:

a. Round coated cast iron access frame, heavy duty scoriated (vandalproof), secured cover. Coated cast iron cleanout ferrule with inside caulk connection and recessed tapered thread bronze plug. Jay R. Smith fig. 4250.

2.08 ROOF DRAINS (Provided & Installed by G.C.)

A. Drains to be same size as connecting roof leader.

B. Install sump pan.

C. Secure drain body to deck with a deck clamp bolted to underside of drain body.

D. Seal extension sleeve to body as required by manufacturer's design. Extension height as required.

E. Protect from roofing tar or gravel entering drain body.

F. Drains to be cast iron with cast iron dome.

G. Manufacturer:
1. General Roof Drain: Jay R. Smith Model 1010.
2. Overflow Roof Drain with 3" high water dam: Jay R. Smith Model 1070 with 3" high PVC standpipe.

2.09 CATCH BASINS (Provided & installed by G.C.)

A. Description: Heavy duty roadway drain, coated cast iron flanged body with vandal proof grate and dome bottom strainer. Galvanized cast iron grate.

B. Make and model: Jay R. Smith model 2570.

PART 3 – EXECUTION

3.01 INSTALLATION OF BASIC IDENTIFICATION

A. General - install plumbing identification in accordance with Specifications Section 220553,

Plumbing Identification Systems.

3.02 INSTALLATION STORM WATER PIPING

A. Changes in direction long sweep bends or 1/8 and/or 1/16 bends.

B. Connections of branches to mains with "Y" fittings and 1/8 and/or 1/16 bends.

C. All connections of horizontal into vertical piping with long turn sanitary "T-Y's".

D. Grade the "horizontal" piping 1/4" per foot, minimum for 3” and less, 1/8” per foot minimum for 4” and longer.

3.03 INSTALLATION OF CLEANOUTS

A. Install in conductor piping and storm building drain piping as indicated on drawings, at each change in direction of piping greater than 45 degrees, at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping, and at base of each conductor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Provide flashing flange and clamping device for cleanouts passing through waterproof membrane.

3.04 INSTALLATION OF ROOF DRAINS

A. Roof drains to be provided and installed by the General Contractor.

B. Coordinate piping work with General Contractor.

3.05 INSTALLATION OF CATCH BASINS

A. All catch basins to be installed by the General Contractor.

B. Coordinate drains and piping with Site Contractor.

3.06 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with requirements of Division 22 Section 220300 – Basic Materials and Methods section "Piping Specialties".

3.07 INSTALLATION OF SUPPORTS, ANCHORS AND SEALS

A. Install supports, anchors and seals in accordance with Division 22 Section 220300 – Basic Materials and Methods section "Supports, Anchors and Seals".

3.08 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

A. Expansion joints – install expansion joints on vertical risers as indicated, and as required by Plumbing Code having jurisdiction.

3.09 FLASHING

A. General

1. Flash openings with 6 lb. metal flashing.
2. Make watertight, allow for expansion and contraction.

B. Waterproof pipes through waterproof walls or floors. See Details on Contract Drawings.

C. Cleanouts

1. Install 6 lb. Nobel "Chloraloy". Extend 12" from flange edge.

D. Roof drains

1. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

2. Install 6 lb. Nobel "Nobelflex" flashing.

3. Turn down into drain. Extend 12" from flange edge.

3.10 ADJUSTING, CLEANING, AND TESTING

A. New drainage piping shall be subjected to hydrostatic pressure test, see requirements in Section 220801, “Plumbing Testing, Adjusting and Balancing”.

3.11 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with construction materials and debris and to prevent damage from traffic and construction work.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 224000 – PLUMBING FIXTURES AND TRIM

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of plumbing fixtures and trim work is indicated by drawings and by requirements of this section.

B. Types of plumbing fixtures required for the project including but not limited to, the following:

1. Water closets.
2. Urinals.
3. Lavatories.
4. Sinks.
5. Mop sinks.
6. Electric water coolers.
7. Specialty faucets.
8. Showers
9. Floor Drain
10. Hose Bibbs
11. Emergency Eye Wash/Showers
12. Drinking Fountains
13. Bathtubs
14. Shower Bases

C. Refer to Division 26 sections for electrical connections to following plumbing fixtures, not work of this section.

1. Electric water coolers.
2. Electronic flush valves and faucets.

1.02 SUBMITTALS

A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, trim etc.

1. Clearly indicate rated capacities of selected models of water coolers.

2. Identify compliance with specified ANSI, UL, ASHRAE and New York State Standards, Codes and Listings and Lead Free Standards. (NSF)

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.

C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

D. Color Charts: Submit manufacturer's standard color charts for fixture colors.

1.03 QUALITY ASSURANCE

A. Plumbing code compliance: Comply with applicable portions of New York State Uniform Fire Protection and Building Code, especially Article 9, Plumbing Requirements, and any local codes or regulations that apply pertaining to plumbing material, and the 2020 IPC.

B. New York State Law plumbing fixtures to comply with New York State Conservation Law 15-0314.

1. Lavatory faucets: 0.5 gpm self-closing faucet, or a metering faucet which limits discharge to a maximum of 0.25 gallons per cycle.
2. Sink faucets: 2.2 gpm.
3. Urinal flush valves: .5 gal. per flush.
4. Water closets: 1.3 gal. per flush.
5. Shower Head: 2.0 gpm

C. Plumbing fixture standards: Comply with applicable portions of National Standard Plumbing Code pertaining to materials and installation of plumbing fixtures.

D. Codes and Standards

1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems.
2. Add NSF Lead Free
3. ARI Standard 1010: "Self-Contained Mechanically-Refrigerated Drinking-Water Coolers".
4. ICC Standard A117.1-09: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".
5. Public Law 90-480: "Architectural Barriers Act of 1968".
6. UL Standard 399: Standard for “Drinking-Water Coolers".
7. Public Law 101-336: "Americans with Disabilities Act".
8. ANSI A117.1 – Accessible and Usable Buildings and Facilities
9. ASHRAE Std 18 – Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.
10. ASME A112.6.1M – Supports for Off-the Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).
11. ASME A112.18.1 – Plumbing Supply Fittings; 2012.
12. ASME A112.19.2 – Ceramic Plumbing Fixtures; 2013.
13. ASME A.112.19.3 – Stainless Steel Plumbing Fixtures (Designed for Residential Use); 2008 (R2013).
14. ASME A112.19.5 – Flush Valves and Spuds for Water Closets, Urinals, and tanks; 2011
15. NSF 61 – Drinking Water System Components – Health Effects; 2014 (Errata 2015).
16. NSF 372 – Drinking Water System Components – Lead Content; 2011

1.04 DELIVERY, STORAGE AND HANDLING

A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.

B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

1.05 SEQUENCE AND SCHEDULING

A. Schedule rough-in installations with the installation of other building components.

PART 2 – PRODUCTS

2.01 PLUMBING FIXTURES

A. General: Type, style, and material indicated, including stops, valves, faucets, strainers, wastes, escutcheons, bolts, screws, bushings, etc.

B. Fixtures of same type must be furnished by single manufacturer.

2.02 MATERIALS

A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.

B. Fittings, trim and accessories to be copper or brass unless otherwise noted.

1. Exposed or semi-exposed: Bright chrome-plated units.
2. Escutcheons: Cast brass, bright chrome-plated with set screw.

C. Stainless steel sheets: ANSI/ASTM A 167, Type 302/304, hardest workable temper.

1. Finish: No. 4, bright, directional polish on exposed surfaces.

D. Steel sheets for baked enamel finish: ANSI/ASTM A 591, coating Class C, galvanized bonderized.

E. Steel sheets for porcelain enamel finish: ANSI/ASTM A 424, commercial quality, Type I.

F. Galvanized steel sheet: ANSI/ASTM A 526, except ANSI/ASTM A 527 for extensive forming, ANSI/ASTM A 525, G90 zinc coating, and chemical treatment.

G. Vitreous china: High quality, free from fire cracks, spots, blisters, pinholes and specks, glaze exposed surfaces, and test for crazing resistance in accordance with ANSI/ASTM C 554.

H. Fiberglass: ANSI Z 124, smooth surfaced, with color selected by Architect/Engineer.

I. Synthetic stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

J. Manufacturer

1. Fixtures: American Standard, Crane, Kohler, Eljer.
2. Flush valves: American Standard, Sloan.
3. Closet seats: Church, Beneke, Bemis.
4. Chair carriers: Josam, Smith, Zurn.
5. Supplies and traps: Fixture manufacturer or McGuire, Eastman Central D, Brass Craft, Bridgeport Brass.
6. Master mixing valves: Powers, Symmons, Leonard.

2.03 PLUMBING FITTINGS, TRIM & ACCESSORIES

A. Refer to the “Plumbing Fixture Schedule” on the contract drawings for plumbing fixture manufacturer / model number information.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install plumbing fixtures level and plumb in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, the original design and the referenced standards.

B. Comply with the installation requirements of ICC Standard A117.1, Public Law 90-480 and Public Law 101-336 with respect to plumbing fixtures for the physically handicapped.

1. Water closets flush valve handle on open side of fixtures.
2. Insulate water supply and drain pipes under wheelchair accessible lavatories and sinks or as otherwise shown on drawings.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Set following in a leveling bed of cement grout.

1. Mop sinks.
2. Tubs.

E. Install a Lead Free stop valve in an accessible location in the water connection to each fixture.

F. Install escutcheons at following locations:

1. Wall penetrations, exposed finished locations.
2. Floor penetrations, exposed finished locations.
3. Ceiling penetrations, exposed finished locations.
4. Within cabinets and millwork.

G. Seal fixtures to walls and floors using silicone sealants or latex caulking. Match sealant color to fixture color.

H. Install a sediment trap at each sink or grouping of sinks in Art Rooms. Install so that trap may be easily serviced and removed.

3.03 EQUIPMENT TO BE FURNISHED BY OTHERS

A. Make complete plumbing connections to fixtures and equipment to be furnished by others. Secure exact locations and roughing-in dimensions before beginning work.

B. Provide approved supplies with stops and escutcheons, cast brass traps and wastes with CO plug and escutcheon.

C. All exposed piping chrome plated.

D. Equipment shall be chrome plated except piping located below equipment.

3.04 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized.

B. Inspect each installed unit for damage and operation. Replace damaged or faulting operating fixtures.

3.05 CLEANING

A. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.

3.06 PROTECTION

A. Provide protective covering for installed fixtures, water coolers and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

3.07 SPARE PARTS

A. Furnish special wrenches, water filters and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

B. Furnish faucet repair kits complete with all necessary washers, springs, pins, and retainers, packings, O-rings, sleeves and seats in a quantity of 1 kit for each 40 faucets.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230000 – GENERAL PROVISIONS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. This Section contains General Provisions related specifically to the Mechanical Work.

1. Quality Assurance.
2. Terminology.
3. Protection.
4. Coordination and Sequencing.
5. General Completion.
6. Demolition.
7. Cutting and Patching.
8. Excavation for Mechanical Work.
9. Concrete for Mechanical Work.

B. Drawings and General Provisions of Contract, including General and Supplementary Conditions, apply to this section.

1.02 QUALITY ASSURANCE

A. Laws, Permits, Inspections.

1. Comply with latest revisions of New York State Uniform Fire Protection and Construction Code, NYSED Manual of Planning Standards, any Local Codes or Regulations that apply.
2. Underwriters Laboratories label required for all electrical materials carrying 50 volts or more.
3. Comply with New York State Energy Conservation Construction Code.
4. Comply to requirements of drawings and specifications that are in excess of governing codes.
5. Comply with Section 1613 of the New York State Building Code for seismic requirements.
6. Do not install work as specified or shown if in conflict with governing code. Notify Engineer and request direction.
7. Pay all Inspection and Permit fees.
8. Provide Certificate of Inspection from all governing authorities.

B. Reference to technical society, organization, body or section made in accordance with the following abbreviations:

1. AIA American Institute of Architects
2. AMCA Air Moving and Conditioning Association, Inc.
3. ANSI American National Standards Institute.
4. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
5. ASME American Society of Mechanical Engineers
6. ASTM American Society of Testing Materials
7. AWSC American Welding Society Code
8. AWWA American Water Works Association
9. IEEE Institute of Electric and Electronics Engineers
10. NEC National Electric Code
11. NEMA National Electrical Manufacturer's Association
12. NFPA National Fire Protection Association
13. NYBFU New York Board of Fire Underwriters
14. NYCRR - Codes, Rules and Regulations of the State of New York.

15. NSF - National Sanitation Foundation
16. PDI - Plumbing and Drainage Institute.
17. SMACNA Sheet Metal and Air Conditioning Contractors National Association
18. UL Underwriters' Laboratories, Inc.

C. Contractor submission of equivalent or substitute items other than those specified is at Contractor convenience only. If a substitution or equivalent is accepted, the Contractor shall coordinate the installation of the substitute or equivalent and make all associated changes required. The Contractor also waives any claim for additional costs associated with the substitute / equivalent which becomes apparent before, during or after installation. The Contractor agrees to bear any and all additional costs to all other contractors or subcontractors which are caused by the incorporation of the substitution / equivalent.

D. The Contractor shall, as part of his contract, furnish and install all equipment, materials, wiring accessories, and on-site installation of equipment as required by current standards of good practice.

E. All materials and equipment to be furnished and installed shall be new and of first quality and be free from all defects.

1.03 TERMINOLOGY

A. The following terminology and definitions are used on this project as related to the Mechanical Work.

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces and tunnels.
2. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
5. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. Sewers: Refer to underground connections from building to street mains. Sewers begin at points 5 feet outside building wall.
7. Service Connections: Refer to underground connections from 5 feet outside building wall to street mains.
8. Underground Lines: Refer to piping buried in earth inside and within 5 feet outside building.
9. Building Lines: Refer to all other lines.
10. For other definitions refer to latest issue of New York State Plumbing Code, and all revisions.

1.04 PROTECTION

A. Protect equipment from damage, including water, chemical, mechanical injury and theft.

B. Replace damaged equipment or components.

C. Close and waterproof between sleeves, openings, pipes and voids in walls, floors and foundations to prevent entrance of water or moisture.

D. Holes made in fire walls, partitions, fire stops, shall be patched to maintain fire rating integrity.

E. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.

F. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

G. Protect flanges, fittings, and piping specialties from moisture and dirt.

H. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

I. If permanently installed air handler equipment/systems are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used in each unit and at each return air grille/opening, as determined by ASHRAE 52.2 Replace all unit filtration media with a Minimum Efficiency Reporting Value (MERV) of 13 immediately prior to occupancy and verify ductwork cleanliness; if ductwork is found contaminated, clean ductwork and associated air handling equipment and replace filtration media.

1.05 COORDINATION AND SEQUENCING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots and openings in building structure during progress of construction, to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors shall be submitted and approved by the engineer.

G. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

H. Coordination with other trades: Right-of-Way as follows:

1. Light Fixtures.
2. Drain Pipes and Vents.
3. Ductwork.
4. HVAC Piping.
5. Domestic Water Piping.
6. Electrical Conduit.

I. Work in existing building.

1. Verify existing locations of pipe, ductwork equipment and conduit in field.

2. Extend existing systems as required for proper tie-in to new systems.
3. Leave existing equipment to be reused in satisfactory working order.
4. Remove from building all existing piping, ductwork, equipment and similar items which do not conform to new layout. Before disposing of these items, determine if Owner wishes to retain them.

J. Changeovers and continuity of services.

1. Make changeovers, tie-ins, removal, and perform similar work that affect operation of present building at times approved by Owner.
2. Make temporary connections required to keep present building systems and equipment in operation.
3. Prior to any shutdown of present building, have necessary materials at site.

1.06 GENERAL COMPLETION

A. Oiling Equipment.

1. Lubricate equipment and motors in accordance with manufacturer's requirements.

B. Instructions to Owner's Representative.

1. Give notice to Engineer when all systems are installed and operating.
2. Obtain name of Owner's Representative to receive instructions.
3. Schedule instructions of Owner's Representative by manufacturer's representative and instruct Owner in system installation and operation for:

a. Heating, Ventilating & Air Conditioning Equipment.
b. Fan equipment.
c. Pumps.
d. Temperature control.
e. Equipment lubrication.
f. Packaged systems.

C. Provide Operation and Maintenance manuals in accordance with the requirements of Division 01 "Project Closeout" Section. Provide an instructional video to the owner of the training / maintenance instruction sessions with the owner.

1.07 PAINTING AND FINISHING

A. Refer to "Painting" Section 099000 for field painting requirements.

B. Damage and Touch-up: Repair marred and damaged factory painted finishes with materials and procedures to match original factory finish.

1.08 DEMOLITION

A. Disconnect, demolish, and remove work specified under Division 23 and as indicated.

B. Where pipe, ductwork, insulation or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches beyond the face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from the project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation. Add cap off and pressure test prior to putting back in service.

1.09 CUTTING AND PATCHING

A. All cutting required to facilitate the proper installation of all work to be installed under Division 23, shall be done by the Mechanical Contractor.

B. Cut, channel, chase and drill floors, walls, partitions, ceilings and other surfaces necessary for mechanical installations in the maner specified and approved by the architect. Perform cutting by skilled mechanics of the trades involved.

C. Repair cut surfaces to match adjacent surfaces.

1.10 EXCAVATION FOR MECHANICAL WORK

A. Description of Work: Types of excavation for mechanical related work specified in this section include:

1. Underground mechanical utilities and services.
2. Underground tanks, casings and equipment enclosures.
3. Exterior water circulation and distribution systems.

B. Project Conditions.

1. Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Liabilities arising out of performance of work is responsibility of Contractor doing excavation.
2. Protect persons from injury at excavations by barricades, warnings, and illumination.
3. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical work on frozen excavation bases or subbases.

1.11 CONCRETE FOR MECHANICAL WORK.

A. Types of concrete for mechanical related work specified in this section include:

1. Lean concrete backfill to support mechanical work.
2. Encasement of mechanical work.
3. Mechanical equipment foundations and housekeeping pads.
4. Inertia bases for isolation of mechanical work.
5. Rough grouting in and around mechanical work.
6. Patching concrete cuts to accommodate mechanical work.
7. Thrust block.

1.12 REBATES

A. The Mechanical Contractor shall assist the Owner in applying for any available rebates from manufacturer’s, utility companies, etc. on equipment or materials installed under the contract. Provide all required documentation and assist in the completion of applications as required to complete the rebate process. All proceeds from rebates remain the property of the Owner.

PART 2 – PRODUCTS

Reference Section 033000.

PART 3 - EXECUTION

3.01 EXCAVATION - GENERAL

A. Do not excavate for mechanical work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.

B. Excavate with vertical sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross bracing to sustain sides of excavation. Remove sheeting and cross bracing during backfilling wherever such removal would not endanger work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.

C. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearances.

D. Depth for direct support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand excavate bottom cut to accurate elevations, undercut at pipe hubs.

E. Depth for subbase support: For large piping (6" pipe size and larger), tanks, and where indicated for other mechanical work, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" below bottom of work to be supported.

F. Depth for unsatisfactory soil or rock conditions: Where directed, (because of unsatisfactory conditions at bottom of indicated excavation), excavate additional depth as directed to reach satisfactory conditions. Backfill with subbase material, compacted as directed, to indicated excavation depth.

G. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).

1. Dispose of excavated material which is either in excess of quantity needed for backfilling, or does not comply with requirements for backfill material.

    a. Remove unused material from project site, and dispose of in lawful manner.

3.02 WATER CONTROL

A. Maintain dry excavations for mechanical work, by removing water. Protect excavations from inflow of surface water. Pump inflow of ground water from excavations, protect excavations from inflow of ground water, by installing temporary sheeting and waterproofing as well as dewatering as required. Provide adequate barriers which will protect other excavations and below grade property from being damaged by water, sediment or erosion from or through mechanical work excavations. Need permit for dewatering – contractor to obtain and pay for.

3.03 BACKFILLING (REFERENCE 310000)

A. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.

B. Install drainage fill where indicated, and tamp to uniform firm density.

C. Backfill with finely graded subbase material to 6" above wrapped, coated and plastic piping and tanks, and to centerline of other tanks.

D. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

E. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously, do not dislocate work from installed positions.

F. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D1557), using power-driven hand operated compaction equipment.

1. Lawn and landscaped areas: 85% for cohesive soils, 90% for cohesionless soil.
2. Paved areas and roadways: 90% for cohesive soils, 95% for cohesionless soils.

G. Backfill to elevations matching adjacent grades, at time of backfilling excavations for mechanical work. Return surfaces to original condition.

H. After covering piping with 6" layer of approved fill, employ General Contractor to backfill, compact excavations beneath:

1. New foundations.
2. Slabs on grade.
3. Areas to be paved by General Contractor.

3.04 CONCRETE BASES

A. Construct concrete equipment bases of dimensions required, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations.

3.05 CONCRETE GENERAL

Reference Section 033000.

3.06 CONCRETE CURING AND PROTECTION

Reference Section 033000.

3.07 MISCELLANEOUS CONCRETE ITEMS

A. Fill in holes and openings left in concrete structures for passage of work by trade unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

3.08 CONCRETE SURFACE REPAIRS (REFERENCE 030130)

A. Repair and patch areas with epoxy or non-shrink grout immediately after removal of forms, when acceptable to Architect/Engineer.

B. Repair areas, except single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

C. Use epoxy-based mortar for structural repairs, where directed by Architect/Engineer.

D. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.09 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Quality Control: Owner's acceptable testing laboratory will perform sampling and testing during concrete placement, which may include the following, as directed by Engineer. This testing does not relieve Contractor of responsibility of providing concrete in compliance with specifications. Contractor shall perform additional testing as necessary, at no expense to Owner, to ensure quality of concrete.

1. Sampling Fresh Concrete: ASTM.
2. Slump: ASTM, one test for each load at point of discharge.
3. Air Content: ASTM C 173, one for each set of compressive strength (specimens of freshly mixed concrete).
4. Compressive Strength: ASTM, one set for each 50 cu. yds. or fraction thereof of each class and type of concrete; 2 specimens tested at 7 days, 3 specimens tested at 28 days, and one retained for later testing if required.
5. Laboratory Cured Test Cylinders: ASTM.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230010 – CODES, STANDARDS, AND PERMITS

PART 1 – GENERAL

1.01 GENERAL

The entire installation shall be made in accordance with State rules and regulations and shall also conform with the Standards of the National Board of Fire Underwriters for this installation and the local Board of Fire Underwriters having jurisdiction. The installation shall also comply with air pollution requirements of the State of New York and Industrial Code Rule 4 of the State of New York Department of Labor, Board of Standards and Appeals, dated March 31, 1965, and all other ordinances having jurisdiction.

The Contractor shall submit to all authorities having jurisdiction all required applications and shall secure all necessary permits, tests, and inspections required for final approval.

Certain standard and staple materials are described by reference to standard specifications. These standards are as follows:

ASA-B9	Safety Code for Mechanical Refrigeration
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
AWWA	American Water Works Association
CS	Commercial Standard
FS	Federal Specification
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal and Air Conditioning Contractors Association
USASI	United States of America Standards Institute
UL	Underwriters' Laboratories
	New York State Uniform Fire Prevention and Building Code
A.A.B.C.	Associated Air Balance Council
N.E.B.B.	National Environmental Balancing Bureau

All new equipment shall bear U.L. label and conform to the latest edition of the National Electric code.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230300 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

1. Submittals.
2. Welder certification.
3. Pipe joining materials and installation instructions common to piping systems.
4. Piping specialties: Escutcheons, dielectric fittings, sleeves and seals.
5. Identifying devices and labels.
6. Nonshrink grout for equipment installations.
7. Drip pans.
8. Fire stopping.
9. Pipe supports: Hangers, clamps, support spacing, building attachments, shields and saddles, flashing, miscellaneous materials, anchors.
10. Field fabricated metal and wood equipment supports.

B. Pipe and pipe fitting materials are specified in piping system sections.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. General - Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Product data for following piping specialties:

1. Mechanical sleeve seals.
2. Identification materials and devices.

C. Samples of color, lettering style and other graphic representation required for each identification material and device.

D. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations.

F. Prepare coordination drawings to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment and materials. Include the following:

a. Planned piping layout, including valve and specialty locations and valve stem movement.
b. Planned duct systems layout, including elbows radii and duct accessories.
c. Clearances for installing and maintaining insulation.
d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
e. Equipment service connections and support details.
f. Exterior wall and foundation penetrations.
g. Fire-rated wall and floor penetrations.
h. Sizes and location of required concrete pads and bases.

G. Floor plans, elevations and details to indicate penetrations in floors, walls and ceilings and their relationship to other penetrations and installations.

H. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

I. Submit weld procedure specifications.

1.04 WELD AND WELDER CERTIFICATION

A. Welder certificates signed by Contractor certifying that welders comply with requirements of this Section.

B. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code - Steel".

1. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping".

1.05 STANDARDS FOR MATERIALS AND WORKMANSHIP

A. All materials and workmanship shall, at a minimum be in accordance with (in no order of precedence):

1. New York State Codes – latest edition as adopted by the Authority Having Jurisdiction, unless otherwise noted.

2. State and municipal Building Codes and related subcodes.

3. Occupational and Safety Act (OSHA) Requirements.

4. Rules and Regulations of the Authority Having Jurisdiction applicable to the work.

5. National Electrical Standards Association Standard for Good Workmanship in Electrical Construction (NECA-1)

6. Serving utility’s rules and regulations for providing service.

7. Contract Drawings and Specifications.

8. Manufacturer recommended installation instructions, practices and procedures for the products being utilized or installed.

9. Where conflicts arise between the above, the more stringent requirement shall be adhered to.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods. Joining methods and pipe installation shall be performed in complete accordance with section 1613 of the Building Code of New York State for building seismic type II, zone C.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 PIPE JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 23 for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch maximum thickness, except where thickness or specific material is indicated.

    a. Full-Face Type: for flat-face, Class 125 cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: for raised-face, Class 250 cast-iron and steel flanges.

2. ASME B16.20 for grooved, ring-joint, steel flanges. Note that grooved, ring joint piping / accessories may be used for sprinkler or condenser water piping systems only.

3. AWWA C110, rubber, flat face, 1/8 inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

D. Solder Filler Metal: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent).
2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent).
3. Allow HA: Tin-antimony-silver-copper-zinc.
4. Alloy HB: Tin-antimony-silver-copper-nickel.
5. Alloy Sb5: Tin (95 percent) and antimony (5 percent).

E. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

F. Welding Fill Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Flanged, Ductile-Iron Pipe Gasket, Bolts and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

H. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47, Grade 32510 or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.03 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe, tube and insulation of insulated piping.
2. Outside Diameter: Completely cover opening.
3. Cast Brass: One-piece, with set-screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome plate.

4. Cast Brass: Split casting, with concealed hinge and set-screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome plate.

5. Stamped Steel: One-piece, with set screw and chrome plated finish.
6. Stamped Steel: One-piece with spring clips and chrome plated finish.
7. Stamped Steel: Split plate with concealed hinge, set-screw, and chrome plated finish.
8. Stamped Steel: Split plate with concealed hinge, spring clips and chrome plated finish.
9. Cast-Iron Floor Plate: One piece casting.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg F temperature.
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers and steel backing washers.

    a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.

6. Dielectric Couplings: Galvanized steel coupling, having inert and non-corrosive, thermoplastic lining, with threaded ends and 300 psig minimum working pressure at 225 deg F temperature.

7. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive, thermoplastic lining, with combination of plain or threaded end types and 300 psig working pressure at 225 deg F temperature.

C. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

D. Sleeves: The following materials are for wall, floor, slab and roof penetrations.

1. Steel Sheet-Metal: 24 gage or heavier, galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.

    a. Penetrating Pipe Deflection: In accordance with International Building Code (latest edition), Chapter 16: seismic requirements, without leakage.
    b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111 of housing and gasket size as required to fit penetrating pipe.
    c. Pipe Sleeve: AWWA C151, ductile-iron pipe.

    d. Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.
5. Cast-Iron Sleeve Fittings: Commercially-made, sleeve having integral clamping flange, with clamping ring, bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with set screws.

2.04 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. Where more than single type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: An accessible and visible location.

C. Snap-On Plastic Pipe Markers: Manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, conforming to ASME A13.1.

D. Pressure-Sensitive Pipe Markers: Manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, conforming to ASME A13.1.

E. Plastic Duct Markers: Manufacturer's standard laminated plastic, color coded duct markers. Conform to following color code:

1. Green: Cold air.
2. Yellow: Hot air.
3. Yellow/Green: Supply air.
4. Blue: Exhaust, outside, return and mixed air.
5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
6. Nomenclature: Include following:

a. Direction of air flow.
b. Duct service (supply, return, exhaust, etc.).
c. Duct origin (from).
d. Duct destination (to).
e. Design cfm.

F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock: Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch, except as otherwise indicated.
5. Thickness: 1/8 inch, except as otherwise indicated.
6. Thickness: 1/16 inch, for units up to 20 square inches or 8-inches long; 1/8 inch for larger units.
7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

G. Plastic Equipment Markers: Laminated-plastic, color-coded equipment markers. Conform to following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any of above criteria.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Nomenclature: Include following, matching terminology on schedules as closely as possible:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

8. Size: Approximately 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.

H. Underground Type Plastic Line Marker.

1. Manufacturer's standard permanent, bright colored, continuous printed plastic tape, intended for direct burial service, not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

I. Lettering and Graphics: Coordinate names, abbreviations and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are indicated, provide identification that indicates individual system number as well as service such as "Boiler No. 3", "Air Supply No. 1H", or "Standpipe F12".

2.05 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

2.06 DRIP PANS

A. Provide drip pans fabricated from corrosion resistant sheet metal with watertight joints, and with edges turned up 2-1/2 inches. Reinforce top, either by structural angles or by folding over according to size. Provide hole, gasket, and flange at low point for watertight joint and 1-inch drain line connection.

2.07 FIRE STOPPING

A. Refer to Specification Section 230680 for details.

2.08 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports. Supports and hangers in conformance with International Building Code (latest edition), Chapter 16: seismic requirements shall be used. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper plated hangers and supports for copper piping systems. Provide spring hangers where piping is subject to vibration movement.

B. Adjustable steel clevises.

1. Material: Carbon steel, copper plated for copper piping.
2. Finish: Black or copper plated.
3. Adjustment: Hanger to be adjustable for vertical height of pipe without removing the pipe.

2.09 VERTICAL PIPING CLAMPS

A. Two bolt riser clamp.

1. Material: Carbon steel copper plated for copper piping.
2. Finish: Black or copper plated.

2.10 HANGER ROD AND SPACING

ROD SIZE AND SPACING SCHEDULE (In accordance with NYSBC 1621)

PIPE SIZE	ROD DIAMETER
2" and smaller	3/8"
2-1/2" thru 3-1/2"	1/2"
4" thru 5"	5/8"
6" and over	3/4"

TYPE	MAXIMUM SPACING
Steel	10’ -0"
Copper	6’- 0"

Note: Cast Iron - support at every hub or coupling 5 ft. maximum spacing.

2.11 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated provide factory fabricated building attachments of one of the following types listed, selected by Installer to suit building substrate conditions. Select size of building attachments to suit hanger rods. Provide copper plated building attachments for copper piping systems. Provide the following where approved by International Building Code (latest edition), Chapter 16:

B. On Structural Steel:

1. For pipes 2" and smaller: C clamps with lock nuts similar to Grinnell figure 86.
2. For pipes 5" and larger: Use beam clamps similar to Grinnell figure 228 or 292.

C. On New Masonry:

1. Use concrete inserts similar to Grinnell figure 281.

D. On Existing Concrete:

1. Use expansion case similar to Grinnell figure 117.

E. On Wood:

1. Use coach screw rods Grinnell figure 111. Ceiling flanges Grinnell figure 153, or fabricated angle clips. Use wood drive screws or lag bolts as fasteners.

2.12 SHIELDS AND SADDLES (Where approved by International Building Code (latest edition), Chapter 16:)

A. General: For insulated piping.

B. Shields: 16 gauge galvanized metal.

Unsul Coustic Corp. "Insul-Shield"

C. Protection saddles:

1. Hardwood block
2. Steel saddle Grinnell 160 series

2.13 FLASHING MATERIALS

A. General: Provide flashings for each penetration of mechanical systems through roofs or waterproof membranes.

B. Molded Pipe Flashing: Compatible with single ply membranes with which it is used and manufactured by membrane manufacturer.

C. Copper flashing: Provide cold-rolled sheet copper (ANSI/ASTM B 370), of proper temper for applications shown and required forming, coated on one side with not less than 0.06 lbs. per sq. ft. of antimony (ANSI/ASTM B 101, Type I, Class A), weighing 1.06 lbs. per sq. ft., except as otherwise indicated.

D. Bituminous coating: FS TT-C-494, or MIL-C-18480, or SSPC-Paint 12, cold applied solvent type bituminous mastic coating for application in dry film thickness of 15 mils per coat.

2.14 MISCELLANEOUS MATERIALS

A. Metal framing: Provide products complying with NEMA STD ML 1.

B. Steel plates, shapes and bars: Provide products complying with ANSI/ASTM A 36.

C. Heavy duty steel trapezes: Fabricate from steel shapes selected for loads required, weld steel in accordance with AWS standards.

D. Pipe guides: Provide factory fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two section outer cylinder and base with a two section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.15 ANCHORS

A. Fabricate pipe anchors from 3 x 3 x 1/2" angle.

B. Use pipe protection saddles one size larger than piping.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: All piping systems, components and their installation shall be in conformance with the International Building Code (latest edition), Chapter 16: for seismic requirements. Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 23 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordinate drawings.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wallboard partitions and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw and polished chrome-plated finish. Use split-casting escutcheons where required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips and chrome-plated finish.
5. Piping in Utility Areas: Cast-brass or stamped-steel with set-screw or spring clips.

N. Sleeves are required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Install large enough sleeves to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger, penetrating gypsum-board partitions.
    b. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal".
    c. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants".

Q. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeve and mechanical sleeve seals. Size sleeve for 1 inch annular clear space between pipe and sleeve for installation of mechanical seals.

1. Install steel pipe for sleeves smaller than 6 inches.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger.
3. Assemble and install mechanical seals according to manufacturer's printed instructions.

R. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

S. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Joint pipe and fittings as follows and as specifically required in individual piping system specification Sections.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS "Soldering Manual", Chapter 22 "The Soldering of Pipe and Tube".
4. Brazed Joints: Construct joints according to AWS "Brazing Manual", Chapter 28 "Pipe and Tube".
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

    a. Note the internal length of threads in fittings or valve ends and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

W. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to "Quality Assurance" article.

X. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

1. Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment, according to manufacturer's printed instructions.

    a. Plain-End Pipe and Socket-Type Fittings: Socket-joining.

Y. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2 inches or smaller threaded pipe connection.
2. Install flanges, in piping 2 1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials or dissimilar metals.
4. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom, where mounting heights are not indicated. Equipment platforms, vibration isolation and restraints shall be provided and installed where described and shall be in conformance with International Building Code (latest edition), Chapter 16:

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.03 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.

2. Locate pipe markers as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

    a. Near each valve and control device.
    b. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
    c. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
    d. At access doors, manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced at a maximum of 50 feet intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.
    g. On piping above removable acoustical ceilings, except omit intermediately spaces markers.

3. During back-filling/top-soiling of each exterior underground piping systems, install continuous underground type plastic line marker, located directly over buried line at 6-inches to 8-inches below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16-inches, install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4 inch high lettering for name of unit where viewing distance is less than 2 feet, 1/2 inch high for distance up to 6 feet, and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

C. Duct Systems: Identify air supply, return, exhaust, intake and relief ducts with duct markers, or provide stenciled signs and arrows, showing duct system service and direction of flow.

1. Location: In each space where ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet.

D. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Provide and install in conformance with International Building Code (latest edition), Chapter 16: Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel".

3.05 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.06 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions

3.07 DRIP PANS

A. Locate drip pans under piping passing over or within 3 ft. horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, and weld rods to

sides of drip pan. Brace to prevent sagging or swaying. Connect 1-inch drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

3.08 FIRESTOPPING

A. See section 230680 for additional fire stopping requirements.

3.09 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations in concrete, in wood or on structural steel for proper piping support. Space attachments within maximum piping span length indicated. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed, fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.10 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure. Supports / hangers shall conform to the requirements of International Building Code (latest edition), Chapter 16: Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Install hangers and supports of same type and style for grouped piping runs.

C. Support fire water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

E. Provisions for movement: International Building Code (latest edition), Chapter 16:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe slopes: Install hangers and supports to provide indicated pipe slopes.

F. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.11 SHIELDS AND SADDLES FOR INSULATED PIPING

A. 4" and below use 16 gauge x 12 inch long shield with oversized hanger outside insulation.

B. 6" and above use hardwood protection saddle with 16 gauge x 18 inch long shield with oversized hanger outside insulation.

C. 6" and above use steel protection saddle. Fill void between shield and pipe with insulation. Cover with vapor barrier. Protect barrier with 16 gauge x 18 inch long shield with oversized hanger outside assembly.

3.12 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.13 FLASHINGS

A. Manufacturer's recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of sheet metal being installed.

B. Coat back side of flashings where in contact with concrete and other cementitious substrates, by painting surface in area of contact with heavy application of bituminous coating, or by other permanent separation as recommended by manufacturer of metal.

C. On vertical surfaces, lap flashings minimum of 3".

D. On sloping surfaces, for slopes of not less than 6" in 12", lap unsealed flashings minimum of 6".

E. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges minimum of 6" for embedment.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230400 – PAINTING OF MECHANICAL WORK

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Types of painting of mechanical related work specified in this section include the following:

1. Exposed piping systems.
2. Exposed ductwork systems.
3. Steel supports, hangers and rods.

B. The scope of painting to be applied as part of the work under Division 15 shall consist of the following:

1. Paint exposed mechanical work throughout entire project including piping, ductwork, and terminal HVAC equipment.
2. Paint uninsulated ductwork and equipment.
3. Paint exposed NON insulated pipe, black steel such as pipe hangers, supporting steel, tanks, and equipment having no prime or only a prime coat finish.

1.02 SUBMITTALS

A. Submit manufacturer's technical information, including analysis of ingredients and application instructions for products used in painting work.

B. Certification by the manufacturer that products supplied comply with State VOC Regulations

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver painting materials to job site in original, new and unopened containers bearing manufacturer's name and label showing the following information:

1. Name and title of material.
2. Manufacturer's stock number and date of manufacture.
3. Contents by volume, for major pigments and vehicles.
4. Thinning instructions.
5. Application instructions.
6. Color name and number.

B. Store materials in approved fire-safe location with adequate ventilation. Area must be kept clean.

1.04 PROJECT CONDITIONS

A. Comply with governing regulations concerning use of and conditions for application of paint. Comply with manufacturer's recommendations and instructions. Do not apply paint in unfavorable conditions of temperature, moisture (including humidity) or ambient contamination (dust and other pollutants).

PART 2 - PRODUCTS

2.01 GENERAL PAINTING PRODUCT REQUIREMENTS

A. Painting products based on a system by Rust-Oleum. Equivalent systems by Devoe and Pratt and Lambert are acceptable.

B. Steel surfaces - normal temperatures:

1. First Coat - Rust-Oleum or equal Red Primer.
2. Second Coat - Rust-Oleum or equal Zinc Chromate Rust-Inhibitive Primer.
3. Third Coat - Rust-Oleum industrial enamels, finish color as directed.

C. Steel surfaces - elevated temperatures above 150 deg. F.

1. First Coat - Rust-Oleum or equal heat resistant primer.
2. Second Coat - Rust-Oleum or equal heat resistant aluminum.
3. Machinery, equipment and apparatus having factory applied prime coat shall be painted as specified above except omit first coat.

D. Exposed canvas on pipe and equipment insulation:

1. First Coat - Primer, Rust-Oleum primer-sealer.
2. Second and third coats - Rust-Oleum Acrylic Series.
3. Colors as directed.

E. Vehicles and thinners: Comply with governing regulations and recognized safe practices in handling, use and drying of paint vehicles and thinners. Compatibility of paint products is the Contractor's exclusive responsibility. Select paint products to ensure freedom from problems relating to vehicles and thinners of type and within limits recommended by paint manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

A. Clean surfaces before applying paint products. Remove oil and grease prior to mechanical cleaning. Comply with paint products manufacturer's instructions for surface cleaning and preparation.

B. Remove surface applied accessories which are not to be painted, and reinstall after completion of painting. Protect non-removable items not to be painted, by covering with paper or plastic film.

C. Ferrous metal surfaces: Remove mill scale and loose rust on surfaces which are not zinc coated or shop/factory prime coated.

1. Clean shop applied prime coats on metal surfaces, and repair (touch-up) prime coats wherever abraded or otherwise damaged, prior to application of paint system.

D. Zinc coated surfaces: Clean with non-petroleum based solvent. Wash with copper sulfate solution and flush with water, unless surface has been pre-treated, or unless treatment is not recommended by manufacturer of prime coat.

3.02 PAINT SYSTEM APPLICATION

A. Comply with manufacturer's recommendations for mixing or stirring paint products immediately before application.

B. Application limitations: Paint every accessible surface of each unit of work indicated to be painted, regardless of whether in location recognized as "concealed" or "exposed" except as otherwise indicated.

1. Omit painting of ductwork and insulated piping above removable ceilings, but apply paint system to pipe hangers, duct hangers and similar unprotected ferrous materials.
2. Omit painting on machined sliding surfaces and rotating shafts of equipment, and on nonferrous finished metals including chrome plate, stainless steel, special anodized aluminum, brass/bronze and copper, and on plastics and similar finished materials, except where specifically indicated to be color-coded by painting.
3. Omit painting on required name plates, labels, identification tags, signs, markers, printed instructions, performance ratings, flow diagrams and similar text and graphics, located within the scope of work indicated to receive paint application.
4. Omit specified prime coat of paint system for metal surfaces where surface has shop applied prime coat of equivalent quality. Apply prime coat on other surfaces to be painted, comply with paint manufacturer's instructions for prime coating where not otherwise indicated. Apply additional prime coats where suction spots or unsealed areas appear.

C. Apply paint in accordance with manufacturer's directions. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance.

D. Apply paint at edges, corners, joints, welds and exposed fasteners in manner which will ensure dry-film thickness equal to that of flat surfaces. Allow sufficient time between successive coats for proper drying (comply with manufacturer's drying instructions).

1. Number of coats: Number indicated is minimum number, apply as many coats as are necessary to cover.
2. Coating thickness: Apply paint in uniform coats without thinning in application thickness recommended by manufacturer for each coat.
3. Apply paint in smooth finish without noticeable texture, cloudiness, spotting, holidays, laps, brush marks, runs, sags, ripples, ropiness and other surface imperfections.

3.03 CLEAN UP AND PROTECTION, PAINTING

A. During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day. Do not leave in paint storage area.

B. Spattered surfaces: Upon completion of painting work, clean paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting work. Correct damage by cleaning, repairing or replacing and repainting as directed. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings installed for protection of work not to be painted, after completion of painting operations. At completion of work by other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

A. Internal electrical control devices that operate starters, controllers, etc. shall be furnished, installed, and wired under Division 23. Such devices shall be included but not necessarily limited to, devices connected to ducts, damper switches, float switches, electric thermostats, safety devices, limit switches, relays, push button controllers, selector switches, pilot lights, extra interlock contacts, etc.

B. Equipment starters and disconnects shall be provided by the mechanical contractor completely mounted and wired to internal controls and shall be wired to incoming and outgoing control connections. Should integral equipment starters, disconnects or control panels be shipped separately, the mechanical contractor shall be responsible for the proper installation and connections from equipment to same. Incoming and outgoing (line and load) power wiring to starters / disconnect switches shall be performed by the electrical contractor.

C. The integration of the existing temperature control system wiring and controls shall be the responsibility of the Contractor under Division 15. The Contractor shall be fully responsible for the satisfactory operation of new equipment with the temperature control system.

D. All control transformers, control devices, starters, and control wiring furnished shall be properly protected with fuse cutouts and fuses or circuit breakers to conform to the National Electric Code, latest edition. All work shall be performed by a licensed electrician.

E. Each piece of equipment shall be provided with permanent type laminated, black finish, white core, phenolic nameplate. Nameplates should indicate the name and number of the unit, voltage, and any interlock reference. Each starter furnished by the Contractor shall be provided with a permanent type laminated, black finish, white core phenolic nameplate. Nameplate shall indicate the name of the unit controlled and the voltage rating. Nameplate shall be secured with adhesives. Plastic tape type labels will not be accepted.

F. All equipment shall be provided with disconnect means (by Mechanical Contractor).

G. All wiring furnished and installed by the mechanical contractor shall be in strict accordance with the latest edition of the National Electrical Code and all State and Municipal Agencies having jurisdiction. Except as specified otherwise, minimum size wire shall be #14 AWG (control) and #12 AWG (power) and shall be run in rigid galvanized steel conduit except as noted hereinafter. All wire shall be Type THHN or as required by code. All conduit connections to motors shall be made with short lengths of neoprene jacketed galvanized flexible metallic conduit (liquitite).

H. All wire and cable shall be new, manufactured of soft drawn copper of not less than 98% conductivity, conforming to ASTM Specifications and the latest requirements of N.E.C. Wire, and cable shall have 600 volt insulation (unless otherwise noted or specified) of the type specified and shall be of the standard AWG sizes as called for on Drawings or specified.

I. The Contractor shall furnish all labor and material required for the installation of the systems. A brief description of the work is as follows:

   1. Furnish all electrical control wiring for the new equipment and controls.

   2. Contractor shall apply final finish to insure uniformity.

   3. All cutting, patching, and painting as required.

   4. All controls for units as hereinbefore specified and disconnect switches.

5. Testing of all mechanical contractor installed wiring as directed.

6. Contractor shall perform all work as stated on the documents for fire alarm fan shutdown for all new applicable equipment, unless noted otherwise.

7. Contractor shall obtain an approved independent electrical inspection certificate, covering all work performed by an electrical inspection agency serving the locality of the project.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230516 – EXPANSION COMPENSATION

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Expansion compensation products required for this project shall be provided and installed in accordance with section 1621 of the New York State Building Code.

B. Expansion compensation products specified in this section include:

1. Fabricated Expansion Loops.

2. Flexible Ball Pipe Joints.

3. Expansion Compensators.

1.02 QUALITY ASSURANCE

A. Refer to Division 01, for requirements pertaining to substitute materials and equipment.

B. Comply with standards of the Expansion Joint Manufacturer's Association (EJMA).

1.03 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of expansion compensation product. Submit schedule showing manufacturer's figure number, size, and location on project.

B. Shop Drawings: Submit shop drawings for fabricated expansion loops indicating location, dimensions, pipe sizes and location and method of attachment of anchors.

C. Maintenance Data: Submit maintenance data and spare parts list for each type of expansion compensation product. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.01 EXPANSION LOOPS

A. General: Fabricate expansion loops as dimensioned and located on the Drawings and elsewhere as determined by installer to provide for adequate control of expansion of the installed piping system. Cold spring the loop prior to connecting to the anchored piping.

2.02 FLEXIBLE BALL PIPE JOINTS

A. General: Provide flexible ball pipe joints where indicated for piping systems, with materials and pressure/temperature ratings selected by Installer to suit intended service. Design joints for 360 degree rotation and with minimum of 30 degree angular flexing movement for sizes 1/4" to 6", 15 degrees for sizes 8" to 30". Provide 2 composition gaskets for each joint.

B. Certify carbon steel joints for environmental shock testing in accordance with MIL-S-4456 or MIL-S-901C.

C. Comply with Section II of ASME Boiler and Pressure Vessel Code and ANSI B31.1 Power Piping for materials and design of pressure containing parts and bolting.

D. Test each assembly with steam at working pressure of piping system for zero leaks before shipment.

E. Manufacturer: Subject to compliance with requirements, provide flexible ball pipe joints of the following:

1. Gustin-Bacon Div., Aeroquip Corp.

2.03 EXPANSION COMPENSATORS

A. Low Pressure: 70 psi, 3/4 inch to 3 inch copper pipe, 2 ply phosphor bronze bellows, brass shroud, male copper tube end.

B. High Pressure: 150 psi, 3/4 inch to 3/ inch steel pipe, 2 ply seamless stainless steel bellows, steel shroud and male thread end or psi, 3/4 inch to 3 inch copper pipe all bronze construction male thread or sweat ends.

C. Manufacturer: Subject to compliance with requirements, provide expansion compensators of one of the following:

1. Flexonics Div., UOP, Inc.
2. Keflex, Mfg. Div.
3. Metraflex Co.
4. Vibration Mountings and Controls, Inc.

2.04 PIPE ALIGNMENT GUIDES

A. General: Provide pipe alignment guides on both sides of expansion joints and elsewhere as indicated. Construct with 3 or 4 finger spider traveling inside a guiding sleeve, with provision for anchoring to building substrate.

B. Manufacturer: Subject to compliance with requirements, provide pipe alignment guides of the following:

1. Flexonics Div., UOP, Inc.
2. Keflex Mfg. Div.
3. Metraflex Co.

2.05 PIPE ANCHORS

A. General: Fabricated anchor, coupling with steel angle clips, teflon lined clamp sleeve, or shaped anchor for welding to pipe.

B. Manufacturer: Subject to compliance with requirements, provide anchors of the following:

1. Flexonics Div., UOP, Inc.
2. Keflex Mfg. Div.

PART 3 - EXECUTION

3.01 EXPANSION LOOPS

A. General: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as determined by Installer for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50 percent of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as indicated, and elsewhere as determined by Installer to properly anchor piping in relationship to expansion loops.

3.02 EXPANSION COMPENSATION FOR RISERS AND TERMINALS

A. General: Install connection between piping mains and risers with at least 5 pipe fittings including tee in main. Install connections between piping risers and terminal units with at least 4 pipe fittings including tee in riser.

3.03 PIPE ALIGNMENT GUIDES AND ANCHORS

A. General: Install alignment guides on both sides of each expansion joint or loop. Provide anchors secured to building structure as required.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230519 – METERS AND GAUGES FOR HVAC PIPING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Thermometers and gages specified in this section include the following:

1. Thermometers and fittings:
2. Pressure gages and fittings:

PART 2 - PRODUCTS

2.01 THERMOMETERS

A. Thermometers:

1. General: Provide and install adjustable, variable angle type thermometers of materials, capacities and ranges indicated.
2. Case: Die cast aluminum finished in baked epoxy enamel, glass front, 9 inches long.
3. Adjustable joint: 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.
4. Tube and capillary: Blue liquid filled, magnifying lens, 1-percent scale range accuracy, shock mounted. (Mercury filled not acceptable).
5. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
6. Stem: Copper plated steel, or brass, for separable socket.
7. Range: Conform to the following:

    a. Hot water: 30 to 240 degrees F with 2 degree F scale divisions.
    b. Chilled water: 30 to 180 degrees F with 2 degrees F scale divisions.

8. Manufacturer:

9. Wika
10. Trerice
11. Weiss
12. Or approved equal

B. Dial Thermometers:

1. General – Provide dial bimetal type adjustable angle thermometers of materials, capacities and ranges indicated, designed and constructed for use in service indicted.
2. Case – Type 300 series stainless steel hermetically sealed.
3. Dial – White finished aluminum with black and blue marking.
4. Pointer – balanced aluminum with black finish.
5. Stem – type 300 series stainless steel 1/4"o.d.internal bimetal coil silicone dampened.
6. Range – conform to the following:

    a. Hot water 20° to 240° F. scale divisions.

7. Manufacturer – subject to compliance with requirements, provide glass thermometers of one of the following:

a. Tel-Tru Mfg. Co.
b. Trerice (H.O.) Co.
c. Weiss Instrument Inc.

C. Thermometer wells:

1. General: Provide thermometer wells of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2 inch extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2. Manufacturer: Same as thermometers.

2.02 PRESSURE GAGES AND FITTINGS

A. Pressure gages:

1. General: Provide "AA" industrial rated liquid filled pressure gages of capacities and ranges indicated, designed and constructed for use in service indicated. All pressure gauges shall be liquid filled unless otherwise specified. Provide gauge cocks for all pressure gauges.
2. Type: General use, 1/2 percent accuracy, ANSI B 40.1 grade A, phosphor bronze bourdon type, bottom connection.
3. Case: Aluminum or brass, glass lens, 4 1/2 inch diameter.
4. Connector: Brass with 1/4 inch male NPT. Provide protective syphon when used for steam service.
5. Scale: White coated aluminum, with permanently etched markings.
6. Range: Conform to the following:

a. Water - 0 - 100 psi.

7. Manufacturer - subject to compliance with requirements, provide pressure gages of one of the following:

a. Ametek, U.S. Gage Div.
b. Trerice
c. Weiss

B. Pressure gage accessories:

1. Gage cocks: Brass cock with 1/4 inch female NPT on each end, and "T" handle brass plug.
2. Syphon: 1/4 inch straight coil constructed of brass tubing with 1/4 inch male NPT on each end.
3. Snubber: 1/4 inch brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
4. Manufacturer: Same as gages.

PART 3 - EXECUTION

3.01 INSTALLATION OF THERMOMETERS

A. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install in the following locations and elsewhere as indicated:

1. At inlet and outlet of each hydronic zone 3-way valve.
2. At inlet and outlet of each hydronic boiler and chiller.

3. At inlet and outlet of each hydronic coil in air handling units, and built-up central systems.
4. At inlet and outlet of each hydronic heat exchanger.
5. At inlet and outlet of each hydronic heat recovery unit.
6. At inlet and outlet of each thermal storage tank.
7. At outlet of domestic hot water heater.
8. Common boiler supply and return header.

C. Thermometer wells: Install in piping tee where indicated, in vertical upright position. Fill well with Thermal grease.

3.02 INSTALLATION OF PRESSURE GAGES

A. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each hydronic pump.
2. At discharge of each pressure reducing valve.
3. At water service outlet.
4. At inlet and outlet of water side for condensers, chillers, and cooling towers.
5. System makeup water line.
6. Accessible hihg point of hydronic piping systems.

C. Pressure gage cocks: Install in piping tee with snubber or syphon if steam.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of valves specified in this section include the following:

1. Gate valves.
2. Globe valves
3. Drain valves.
4. Ball valves.
5. Butterfly valves (where specifically approved by engineer only).
6. Check valves.

    a. Wafer Check (where specifically approved by engineer only).

1.03 QUALITY ASSURANCE

A. Marking of valves - comply with MSS SP-25.

B. Valve dimensions - for face-to-face and end-to-end dimensions of flanged or welding end valve bodies, comply with ANSI B16.10.

C. ASME Compliance: ASME 1331.9 for Building Services Piping.

D. Valve types. Provide valves of same type by same manufacturer.

1.04 SUBMITTALS

A. Product data - submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location and valve features for each required valve.

B. Maintenance data - submit maintenance data and spare parts lists for each type of valve. Include this data in Maintenance Manual.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle valves and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged valves or components, replace with new.

B. Store valves and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide factory fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated, provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube and equipment connections. Where more than one type is indicated, selection is engineer's option.

B. Valve Features

1. Bypass- when shown provide manufacturer's standard bypass piping and valving.
2. Drain - when shown provide threaded pipe plugs complying with Division 15 "Hot & Chilled water piping" section.
3. Flanged - valve flanged complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).
4. Threaded - valve ends complying with ANSI B2.1
5. Solder joint - valve ends complying with ANSI B16.18.
6. Trim - fabricate pressure containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry.
7. Renewable seat - design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.
8. Extended stem - increase stem length 2" minimum, to accommodate insulation applied over valve.

C. Valve Definitions

1. Mechanical actuator - factory fabricated gears, gear enclosure, external chain attachment and chain designed to provide mechanical advantage in operating valve.
2. Bonnet - part of gate or globe valve through which stem passes to valve body, and attached to valve body by screws, bolts union, or welding.
3. Solid wedge - one piece tapered disc in gate valve, designed for contact on both sides.
4. Outside screw and yoke (OS&Y) - stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.
5. Inside screw, non-rising stem - stem and handwheel designed to rotate without rising when valve is operated from closed to open position.
6. Tight shutoff - butterfly valve designed for flow regulation, and manufactured to be tight in closed position.

2.02 GLOBE VALVES

A. Packing - select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

B. Composition discs - where required, provide suitable material for intended service. For stem throttling service, fit composition disc valve with throttling nut. For metal seated globe valves, provide hardened stainless steel disc and seat ring.

C. Comply with the following standards:

1. Cast iron valves - MSS SP-85.
2. Bronze valves - MSS SP-80.
3. Steel valves - ANSI B16.34.

D. For HVAC hot and chilled water service:

1. Threaded ends 2" and smaller - Class 150, bronze body, union bonnet, rising stem, composition disc.
2. Soldered ends 2" and smaller - Class 125, bronze body, screwed bonnet, rising stem, composition disc.
3. Flanged ends 2 1/2" and larger - Class 125, iron body, bolted bonnet, rising stem, OS&Y, renewable seat and disc.

E. Manufacturer - subject to compliance with requirements, provide globe valves of one of the following:

1. Jenkins Bros, A Corp.
2. Kennedy Valve
3. Stockham Valves and Fittings, Inc.

2.03 DRAIN VALVES

A. For low pressure drainage service:

1. Threaded ends 2" and smaller - Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.
2. Soldered ends 2" and smaller - Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.

B. Manufacturer - subject to compliance with requirements, provide drain valves of one of the following:

1. NIBCO, Inc.
2. Watts

2.04 BALL VALVES

A. Comply with the following standards:

1. Cast iron valves - MSS SP-72.
2. Steel valves - ANSI B16.34.

B. For HVAC hot and chilled water service:

1. Threaded ends 2" and smaller - Class 125, bronze 2 piece body, full port, bronze ball, bronze stem.
2. Soldered ends 2" and smaller - Class 125, bronze 2 piece body, full port, bronze ball, bronze stem.

C. Manufacturer - subject to compliance with requirements, provide ball valves of one of the following:

1. Jenkins Bros.
2. Stockham Valves & Fittings
3. Watts

2.05 BUTTERFLY VALVES (only where specifically approved by the engineer)

A. General - comply with MSS SP-67. Valves to be tight shutoff. Where butterfly valves are used as shutoffs for terminal or equipment removal or repair, select lug type valves. Select wafer type valves for other applications. Provide gear operators on butterfly valves 8" and larger.

B. For HVAC hot and chilled water service:

1. Lug type 3" and larger - Class 150, ductile iron body, lever operated, cadmium plated ductile iron disc, Type 316 stainless steel stem, EPT or EPDM seat.

C. Manufacturer - subject to compliance with requirements, provide butterfly valves of one of the following:

1. Demco Inc.
2. Jenkins Bros., A Corp.
3. Mark Controls Corp., MCC Centerline.
4. Stockham Valves and Fittings, Inc.
5. Crane Co., Valve Division

2.06 WAFER CHECK VALVES (only where specifically approved by the engineer)

A. General - provide wafer style, butterfly type, spring actuated check valves designed to be installed with gaskets between two standard Class 125 flanges. Construct iron body valves with pressure containing parts of materials conforming to ANSI/ASTM A-126, Grade B. Support hanger pins on both ends by removable side plugs.

B. For water service:

1. 2" and larger - Class 125, cast iron body, stainless steel trim, bronze disc, Buna-N seal.

C. Manufacturer - subject to compliance with requirements, provide wafer check valves of one of the following:

1. Bell & Gossett, ITT Fluid Handling Div.
2. Metraflex Co.
3. NIBCO, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General - except as otherwise indicated, comply with the following requirements:

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation - where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

C. Applications subject to shock - install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.

D. Applications subject to corrosion - do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.

E. Mechanical actuators - install mechanical actuators with chain operators where indicated, and where valves 4" and larger are mounted more than 7'-0" above floor in mechanical rooms, boiler rooms, and where recommended by valve manufacturer because of valve size, pressure differential or other operating condition making manual operation difficult.

F. Selection of valve ends (pipe connections) - except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.

1. Copper tube size 2" and smaller - soldered joint valves except ball valves used in plumbing systems.
2. Steel pipe, size 2" and smaller - threaded valves.
3. Pipe size 2 1/2" and larger - flanged valves.

G. Valve system - select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

H. Non-metallic disc - limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

I. Renewable seats - select and install valves with renewable seats, except where otherwise indicated.

J. Fluid control - except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.1. Where throttling is indicated or recognized as principal reason for valve, install globe or butterfly valves.

K. Installation of Check valves: Wafer check valves – install between two flanges in horizontal or vertical position for proper direction of flow.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230548 – VIBRATION ISOLATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work specified in this section.

B. This section is a Division 23 Basic Materials and Methods section, and is a part of each Division 23 section making reference to vibration isolation products specified herein. Vibration isolation devices shall conform to the seismic requirements of the New York State Building Code. Isolators shall allow the amount of movement required by this code and shall be equipped with limit stops as required by this code.

1.02 DESCRIPTION OF WORK

A. Types of vibration isolation products specified in this section include the following:

1. Fiberglass Pad and Shapes
2. Neoprene Pads
3. Cork/Neoprene Pads
4. Equipment Rails
5. Fabricated Equipment Bases
6. Roof Curb Isolators
7. Isolation Hangers
8. Riser Isolators
9. Riser Support Isolators
10. Flexible Duct Connectors
11. Flexible Pipe Connectors

B. Vibration isolation products furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 23 sections.

C. Refer to other sections of these specifications for equipment foundations, hangers, sealants, gaskets and other work related to vibration isolation work.

1.03 QUALITY ASSURANCE

A. Product qualification - provide each type of vibration isolation unit produced by specialized manufacturer, with not less than 5 years successful experience in production of units similar to those required for this project.

1.04 SUBMITTALS

A. Product data - submit manufacturer's specifications, detailed drawings, performance characteristics data and installation instructions for each type of unit required.

1. Include data for each type and size of unit, showing isolation efficiency, stiffness, natural frequency and transmissibility at lowest operating speed of equipment.
2. Where required, include independent test agencies certified report of test results for each type of unit.

3. For spring units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.
4. For spring and pad type units, show basis of spring rate selection for range of loading weights.
5. Include performance certifications where required.

B. Shop drawings - submit shop drawings showing structural design and details of inertia bases, steel beam bases and other custom fabricated work not covered by manufacturer's submitted data.

1. Furnish templates to fabricators of equipment bases, foundations and other support systems, as needed for coordination of vibration isolation units with other work.

C. Submit shop drawings indicating scope of vibration isolation work and locations of units and flexible connections. Include support isolation points for piping and ductwork including risers, air housings and inertia bases.

1. Include schedule of units, showing size or manufacturer's part number, and weight supported and resulting deflection of each unit.

PART 2 - PRODUCTS

2.01 ISOLATION MATERIALS AND SUPPORT UNITS

A. Fiberglass pads and shapes - glass fiber of not more than 0.18 mil diameter, produced by multiple-flame attenuation process, molded with manufacturer's standard fillers and binders through 10 compression cycles at 3 times rated load bearing capacity, to achieve natural frequency of not more than 12 Hertz, in thicknesses and shapes required for use in vibration isolation units.

B. Neoprene pads - oil resistant neoprene sheets, of manufacturer's standard hardness and cross ribbed pattern, designed for neoprene in shear type vibration isolation, and in thicknesses required.

C. Cork/Neoprene pads - close grained composition cork sheet, laminated between 2 sheets of ribbed oil resistant neoprene, in thicknesses required.

D. Vibration isolation products furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 23 sections.

E. Refer to other sections of these specifications for equipment foundations, hangers, sealants, gaskets and other work related to vibration isolation work.

F. Equipment rails - where rails or beams are indicated for use with isolator units to support equipment, provide steel beams complying with ANSI/ASTM A36, with minimum depth of 6" or 0.08 x span of beam between isolators (whichever is greater). Provide welded bracket at each end of beams, and anchor each end to spring isolator unit. Provide bolt holes in beams matching anchor bolt holes in equipment. Provide beams of section modulus indicated or, if not indicated, selected for normal-weight equipment loading to limit static load stress to 16,000 psi.

1. Except as otherwise indicated, position equipment on equipment rails so that load will be equally supported by isolator units.

G. Fabricated equipment bases - where supplementary bases are indicated for use with isolator units to support equipment (base not integral with equipment), provide welded unit, fabricated of structural steel shapes, plates and bars complying with ANSI/ASTM A36, as shown. Provide welded support brackets at points indicated, and anchor base to spring isolator units.

H. Except as otherwise indicated, arrange brackets to result in the lowest possible mounting height for equipment. Provide bolt holes in base matching anchor bolt holes in equipment.

1. Where indicated, provide auxiliary steel base for support of motor, mounted on equipment base with slotted anchor bolt holes for adjustment of motor position.
2. Where sizes of base framing members are not indicated, fabricate base with depth of structure not less than 0.10 x longest span of base, rigidly braced to support equipment without deflections or distortions which would be detrimental to equipment or equipment performances.

I. Roof-curb isolators - fabricated frame units sized to match roof curbs as shown, formed with isolation springs between extruded aluminum upper and lower sections, which are shaped and positioned to prevent metal-to-metal contact. Provide continuous airtight and waterproof seal between upper and lower extrusions. Include provisions for anchorage of frame unit to roof curb, and for anchorage of equipment to unit.

J. Isolation hangers - hanger units formed with brackets and including manufacturer's standard compression isolators of type indicated. Design brackets for 5 times rated loading of units. Fabricate units to accept misalignment of suspension members, and for use with either rod or strap type members and including acoustical washers to prevent metal-to-metal contacts.

1. Provide vibration isolation spring with cap and pad type isolator, securely retained in unit.
2. Provide neoprene pad, securely retained in unit.
3. Provide fiberglass pad or shape, securely retained in unit, with threaded metal top plate.
4. Provide removable spacer in each unit, to limit deflection during installation to rated-load deflection.

K. Riser isolators - manufacturer's standard pad type isolator bonded to steel plate, formed for welding to pipe sleeve extension.

L. Riser support isolators - manufacturer's standard pad type isolator laminated between two formed steel plate members, one for welding to pipe sleeve extension and other for welding to pipe riser.

M. Flexible duct connectors - laminated flexible sheet of cotton duct and sheet elastomer (butyl, neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure indicated. Form connectors with full faced flanges and accordian bellows to perform as flexible isolation unit, and of manufacturer's standard length for each size unless otherwise indicated. Equip each unit with galvanized steel retaining rings for airtight connection with ductwork.

N. Flexible pipe connectors:

1. For non-ferrous piping, provide bronze hose covered with bronze wire braid with copper tube ends or bronze flanged ends, brase-welded to hose.
2. For ferrous piping, provide stainless steel hose covered with stainless steel wire braid with NPT steel nipples or 150 psi ANSI flanges, welded to hose.
3. Rubber flexible pipe connectors - provide of rubber and butyl construction with integral full faced duck and butyl flanges, internally steel wire reinforced, and furnished complete with steel retaining rings. Select with temperature and pressure ratings to suit intended service.
4. Manufacturer - subject to compliance with requirements, provide vibration isolation products of one of the following:

    a. Korfund Dynamics Corp.
    b. Mason Industries, Inc.
    c. Vibration Eliminator Co., Inc.
    d. Vibration Mountings and Controls, Inc.

PART 3 - EXECUTION

3.01 PERFORMANCE OF ISOLATORS

A. General - comply with minimum static deflections recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers, including definitions of critical and noncritical locations, for selection and application of vibration isolation materials and units as indicated.

B. Manufacturer's recommendations - except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.02 APPLICATIONS

A. General - except as otherwise indicated, apply the following types of vibration isolators at indicated locations or for indicated items of equipment. Selection is Installer's option where more than one type is indicated.

B. Neoprene pad type isolators - install where the following equipment is indicated:

1. Floor mounted air handling units, in noncritical locations.
2. Rooftop units mounted on dunnage. (as well as internal spring isolator).

C. Equipment rails and spring isolators - install where the following floor mounted equipment is indicated:

1. Air handling units, 7 1/2 H.P. and larger.
2. Centrifugal fans, 7 1/2 H.P. and larger.

D. Fabricated equipment base and spring isolators - install where the following equipment is indicated:

1. Centrifugal fans.
2. Reciprocating refrigeration compressor, in noncritical locations.

E. Roof curb isolators - install where the following equipment is located on roof curbs over critical locations:

1. Air handling units.
2. Rooftop air conditioning units.
3. Fan or blower units, of more than 1.5 H.P.

F. Isolation hangers - install where the following suspended equipment is indicated:

1. Package air handling units.
2. Pipe over 1" pipe size, located in mechanical equipment rooms and each run connected to vibration isolation mounted equipment for a distance of 100 diameters but not less than 50' - 0".
3. Ductwork (except flexible ductwork), located in mechanical equipment rooms, and each run connected to vibration isolation mounted equipment for a distance of 50' - 0".
4. Sound traps in ductwork.
5. Ductwork, where air velocity is 3000 fpm or greater.

G. Riser isolators - install where the following risers pass through floors and roofs, provide support type where riser support is required:

1. Pipe risers.

2. Pipe risers, within 50' - 0" of connection with vibration isolation mounted equipment.
3. Pipe risers, in critical locations.
4. Pipe risers, 2" pipe size and larger, in critical locations.
5. Ductwork risers, in critical locations.
6. Ductwork risers, where air velocity is 3000 fpm or greater.
7. Ductwork risers, within 50' - 0" of connection with vibration isolation mounted equipment.

H. Flexible duct connectors - install at the following ductwork connections:

1. Connections with vibration isolation mounted air handling equipment.
2. Connections with fixed wall louvers for air intake and exhausts.
3. Where ductwork, 1.0 square foot and greater, changes directions in critical locations.

I. Flexible pipe connectors - install in piping systems at the following location:

1. Connections, 3/4" pipe size and larger, with vibration isolation mounted equipment.

3.03 INSTALLATION

A. General - except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.

B. Anchor and attach units to substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.

C. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

D. Locate isolation hangers as near overhead support structure as possible.

E. Weld riser isolator units in place as required to prevent displacement from loading and operations.

F. Bond flanges of flexible duct connectors to ducts and housings to provide airtight connections. Seal seams and penetrations to prevent air leakage.

G. Flexible pipe connectors - install on equipment side of shutoff valves, horizontally and parallel to equipment shafts wherever possible.

3.04 DEFLECTION MEASUREMENTS

A. Upon completion of vibration isolation work, prepare report showing measured equipment deflections for each major item of equipment as indicated.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230580 – MECHANICAL TESTING REQUIREMENTS

PART 1 – GENERAL

1.01 INCLUDED SYSTEMS AND EQUIPMENT

A. The following is a partial list of the equipment and system test requirements included in this section:

1. Air handler systems
2. Building management control system & energy management
3. Hydronic piping and HVAC Pumps
4. Exhaust fans
5. Indoor air climate control--misc. systems
6. Indoor air quality (IAQ)
7. Terminal unit
8. Test and balance (TAB) work
9. Air Conditioning Equipment

1.02 DESCRIPTION

A. This section specifies the functional testing requirements for Division 15 systems and equipment. From these requirements, the Commissioning Authority (CA) shall develop step-by-step procedures to be executed by the Subs or the Commissioning Authority. The general functional testing process, requirements and test method definitions are described in Section 01810 Commissioning. The test requirements for each piece of equipment or system contain the following:

1. The contractors responsible to execute the tests, under the direction of the CA.
2. A list of the integral components being tested.
3. Construction checklists associated with the components.
4. Functions and modes to be tested.
5. Required conditions of the test for each mode.
6. Special procedures.
7. Required methods of testing.
8. Required monitoring.
9. Acceptance criteria.
10. Sampling strategies allowed.

1.03 PREREQUISITES

A. The following applicable generic prerequisite checklist items are required to be listed on each written functional test form and be completed and checked off by CA prior to functional testing.

B. All related equipment has been started up and start-up reports and construction checklists submitted and approved ready for functional testing.

C. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed.

1. Piping system flushing complete and required report approved.
2. Water treatment system complete and operational.
3. Vibration control report approved (if required).

4. Test and balance (TAB) complete and approved for the hydronic system.
5. All A/E punch list items for this equipment corrected. These functional test procedures reviewed and approved by installing contractor.
6. Safeties and operating ranges reviewed by the CA.
7. Test requirements and sequences of operation attached.
8. Schedules and set points attached.
9. False loading equipment, system and procedures ready.
10. Sufficient clearance around equipment for servicing.
11. Record of all values for pre-test set points changed to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).
12. Other miscellaneous checks of the pre-functional checklist and start-up reports completed successfully.

1.04 MONITORING

A. Monitoring is a method of testing as a stand-alone method or to augment manual testing.

B. All points listed in the required monitoring section of the test requirements which are control system monitored points shall be trended by the Temperature Controls Contractor. Other points shall be monitored by the CA using data loggers. At the option of the CA, some control system monitoring may be replaced with data logger monitoring. At the CA's request, the Temperature Controls Contractor shall trend up to 20% more points than listed herein at no extra charge.

C. Hard copies of monitored data must be in columnar format with time down the left column and at least 5 columns of point values on the same page.

D. Graphical output is desirable, and will be required for all output, if the system can produce it.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

The following Sample test procedures are representative of the level of detail required for this project. The Owner reserves the right to work with the Contractor to amend these data sheets as necessary at no extra cost to the Owner.

3.01 AIR HANDLER UNITS (AHU / RTU)

A. Parties Responsible to Execute Functional Test

1. Temperature Controls Contractor: operate the controls to activate the equipment as needed.

2. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested
Construction Checklist ID PC-_____
PC-_____

1. AHU/RTU and components (fans, coils, valves, ducts, VFD)
2. Heat recovery coil, humidifier or evaporative cooling sections.

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The

commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

D. Functions/Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are an addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both[3]	Required Seasonal Test[1]
General 1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Mixed & supply air, & reset temperature control functions.	Both	
3. Economizer functions.	Both	Cooling
4. SF, and exhaust fan interlocks.	Either	
5. No CCV flow when there is HCV flow.	Both	
6. CCV & HCV modulation & positive shutoff (no leak-thru).	Manual	
7. Duct static pressure (SP) control.	Both	
8. Exhaust fan tracking and building SP.	Monitoring	
9. VFD (or inlet vanes) operation on SF and RF: modulation to minimum, control system PID, proportional band of speed vs controlling parameter, constancy of static pressure, verification of program settings, alarms, etc.	Both	[2]
10. Damper interlocks and correct modulation in all modes, including smoke and fire dampers.	Manual	
11. Temperature difference across HC & CC per specifications.	Manual	
12. Verification of minimum OSA control through varying VAV box positions.	Either	[2]
13. Heating and cooling coils freeze protection.	Manual	[2]
14. Branch duct control damper control.	Manual	
15. Night low limit, morning warm-up cycle.	Either	
16. Heat recovery operation.	Monitoring	
17. Verify TAB reported SF cfm with control system reading.	Manual	[2]
18. All alarms (low limits, high static, etc.).	Manual	
19. Heating and cooling coil capacity test, optional.	Manual	Design
20. Sensor and actuator calibration checks: on duct static pressure sensor on SAT, MAT, OSAT, OSA & RA damper and valve positions, SF cfm reading with TAB, and other random checks (EMS readout against hand-held calibrated instrument or observation must be within specified tolerances)	Manual	
21. Verify schedules and setpoints to be reasonable and appropriate		

[1]Cooling season, Heating season or Both. “Design” means within 5°of season design (ASHRAE 2 1/2%),

or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.
[2]Seasonal test not required if seasonal conditions can be adequately simulated.
[3]Refer to Special Procedures

E. Special Procedures (other equipment to test with, etc.; reference to function ID)

1. Reduced Testing for Smaller Units. For standard application AHU's less than 15 tons, the following modifications to the testing requirements apply: 1) either Manual or Monitoring will satisfy the verification requirement--where both is listed, choose one. 2) Testing Modes 6, 8, 11, 13 and 16 is not required.

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the Temperature Controls Contractor. Other points shall be monitored by the CA using data loggers. Refer to the Monitoring section at the beginning of Section 15997 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each AHU being tested:					
RAT	5	5 days incl. weekend	Y	Y	1-3, 5
SAT	5	5 days incl. weekend	Y	Y	1-3, 5
CC LAT (optional)	5	5 days incl. weekend	Y	Y	1-3, 5
HC LAT (optional)	5	5 days incl. weekend	Y	Y	1-3, 5
MAT	5	5 days incl. weekend	Y	Y	1, 3
Indoor WB or enthalpy, if enthalpy economizer	5	5 days incl. weekend	Y	Y	1, 3
SF speed, if variable, else status	5	5 days incl. weekend	Y	Y	1, 5-9
RF speed, if variable, else status	5	5 days incl. weekend	Y	Y	1, 5-9
Duct SP	5	5 days incl. weekend	Y	Y	1, 7, 9
Building SP differential	5	5 days incl. weekend	Y	Y	8
OSAT	5	5 days incl. weekend	Y	Y	All
OSA-WB or enthalpy, if enthalpy economizer	5	5 days incl. weekend	Y	Y	1, 3
Indoor dry-bulb zones (expected to be most problematic)	5	5 days incl. weekend	Y	Y	All

Remarks:

CCV position (optional)
HCV position (optional)
SF cfm not required if not monitored
RF cfm not required if not monitored

G. Acceptance Criteria (referenced by function or mode ID)

1. 1-21. For the conditions, sequences and modes tested, the AHU/RTU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. AHU/RTU with supporting systems shall be able to maintain the SA temperature within 1.0F either side of the deadband of the current setpoint without excessive hunting.

3. AHU/RTU and controls shall control the duct static pressure so that it does not drift more than an amount equal to 10% of the setpoint value either side of the deadband without excessive hunting.

H. Sampling Strategy for Identical Units

1. All identical AHU's/RTU's over 15 tons shall not have any sampling--test all units. However, 25% of the units may have monitoring be the verification method for modes listed with Monitoring or Both as testing methods, with no less than three units being fully tested per the above requirements.

2. All identical AHU's/RTU's equal to or less than 15 tons shall be sampled: Randomly test at least 50% of each group of identical equipment (the 1st sample) per the above tests. In no case test less than three units in each group. If 20% of the units in the first sample fail the functional performance tests, test another the remaining 50%, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

3. All units not included in the sampling testing and monitoring shall be fully monitored for the monitoring modes listed above in the monitoring section.

3.02 BOILER SYSTEM (HEATING WATER)

A. Parties Responsible to Execute Functional Test

1. Temperature Controls Contractor: operate the controls, as needed.

2. HVAC mechanical contractor or vendor: assist in testing sequences.

3. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested

	Construction Checklist ID
1. Boiler	PC-____
2. Primary HW supply pumps	PC-____
3. Heating water piping system	PC-____
4. Secondary HW supply pumps	PC-____
5. VFD on secondary pumps	PC-____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements.

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test[1]
General 1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unnoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Primary Side. Lead/lag staging of boilers, optimization, capacity modulation, and primary HW supply pumps.	Both	Heating
3. Secondary Side. Secondary WH supply pump staging, bypass valve operation, if no VFD and HWT reset. VFD operation: modulation to minimum, control system PID, proportional band of speed vs controlling parameter, verification of program settings,, alarms, etc.	Both	Heating
4. Check all alarms and safeties (high and low pressure and temperature, etc.), PRV and flow switch functions	Manual	
5. Test each possible lead boiler as lead boiler, and each pump as lead pump. Test pump lockouts.	Manual	
6. Flue gas analysis verification, optional	Manual	
7. Efficiency and capacity tests, optional	Manual	Heating
8. Verify boiler inlet/outlet pressures with startup report and manufacturer's recommendations	Manual	
9. Sensor and actuator calibration checks on: HWST, HWRT, pressure sensor controlling pump speed, mixing valve and other random checks (EMS readout against hand-held calibrated instrument must be within 0.5°F for temps. or within a tolerance equal to 10% of the pressure setpoint, with a test gage)	Manual	
10. Constancy of differential pressure (pump control parameter)	Monitoring	Heating
11. Verify schedules and setpoints to be reasonable and appropriate		

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

E. Special Procedures (other equipment to test with, etc.; reference to function ID)

1. False load boiler, if necessary.

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the Temperature Controls Contractor. Other points shall be monitored by the CA using data loggers. Refer to the Monitoring section at the beginning of Section 15997 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each boiler and pump:					
Boiler current or status	5	5 days incl. weekend	Y	Y	1-3
HWST	5	5 days incl. weekend	Y	Y	1, 3
HWRT	5	5 days incl. weekend	Y	Y	1, 3
OSAT-DB	5	5 days incl. weekend	Y	Y	1-3
HWS primary pump current or status	5	5 days incl. weekend	Y	Y	1, 2
HWS secondary pump speed, if variable	5	5 days incl. weekend	Y	Y	1, 3
HWS secondary pump flow rate, if in EMS	5	5 days incl. weekend	Y	Y	1, 3
HWS secondary pump speed controlling parameter value	5	5 days incl. weekend	Y	Y	1, 3, 10

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1. 1-11. For the conditions, sequences and modes tested, the boilers, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. Boiler shall maintain the supply water set point to within +/- 1.0F of set point dead band without excessive hunting.

3. 9.-10. Pumping system and controls shall maintain the current desired pressure set point to within an amount equal to 10% of the set point value either side of the dead band without excessive hunting.

H. Sampling Strategy for Identical Units

1. No sampling, test all.

3.03 BUILDING AUTOMATION SYSTEM (BAS)

A. Parties Responsible to Execute Functional Test

1. Temperature Controls Contractor: operate the controls to activate the equipment.

2. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested

	Construction Checklist ID
1. Building Automation System	PC-_____

2. All construction checklists of controlled equipment

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The

commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

D. A significant part of the BAS functional testing requirements is the successful completion of the functional tests of equipment the BAS controls or interlocks with. Uncompleted equipment functional tests or outstanding deficiencies in those tests lend the required BAS functional testing incomplete.

E. Integral or stand-alone controls are functionally tested with the equipment they are attached to, including any interlocks with other equipment or systems and thus are not covered under the BAS testing requirements, except for any integrated functions or interlocks listed below.

F. In addition to the controlled equipment testing, the following tests are required for the BAS, where features have been specified. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in the specifications.

	Function / Mode	Test Method Manual (demonstration), Monitoring, Either or Both
MISC. FUNCTIONS		
1.	All specified functions and features are set up, debugged and fully operable	Verbal discussion of features
2.	Power failure and battery backup and power-up restart functions	Demonstration
3.	Specified trending and graphing features demonstration	See equipment trends
4.	Global commands features	Demonstration
5.	Security and access codes	Demonstration
6.	Occupant over-rides (manual, telephone, key, keypad, etc.)	Demonstration
7.	O&M schedules and alarms	Demonstration
8.	Scheduling features fully functional and setup, including holidays	Observation in terminal screens or printouts
9.	Date and time setting in central computer and verify field panels read the same time	Demonstration
10.	Included features not specified to be setup are installed (list)	Demonstration
11.	Occupancy sensors and controls	Demonstration
12.	Demonstrate functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad	Demonstration of 100% of panels and 10% of ports
13.	All graphic screens and value readouts completed	Demonstration
14.	Setpoint changing features and functions	Done during equipment testing
15.	Communications to remote sites	Demonstration
16.	Sensor calibrations	Sampled during equipment tests
17.	“After hours” use tracking and billing	
18.	Final as-builts or redlines (per spec) control drawings, final points list, program code, setpoints, schedules, warranties, etc. per specs, submitted for O&Ms.	Observation
19.	Verify that points that are monitored only, having no control function, are checked for proper reporting to BAS.	Observation

	Function / Mode	Test Method Manual (demonstration), Monitoring, Either or Both
INTEGRATED TESTS		
20.	Fire alarm interlocks and response	Demonstration
21.	Duty cycling (if specified)	Monitoring
22.	Demand limiting (including over-ride of limiting)	Monitoring
23.	Sequential staging ON of equipment	Either
24.	Optimum start-stop functions	Monitoring
25.	All control strategies and sequences not tested during controlled equipment testing	Either
26.	Other integrated tests specified in the contract documents	
27.	Security system interlocks	Demonstration
28.	Fire protection and suppression systems	Demonstration

G. Special Procedures (other equipment to test with, etc.; reference to function ID) None

H. Additional Required Monitoring

1. Besides the trending and monitoring required with the functional testing of equipment, all points listed below which are control system monitored points shall be trended by the Temperature Controls Contractor. Other points shall be monitored by the CA using data loggers. Refer to the Monitoring section at the beginning of Section 15997 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
Misc. equipment current or status for duty cycling and demand limiting	5	5 days incl. weekend	Y	Y	21-22
Equipment or building kW or current for demand limiting	5	5 days incl. weekend	Y	Y	21-22
Optimum start/stop equip.	5	5 days incl. weekend	Y	Y	24

Remarks:

I. Acceptance Criteria (referenced by function or mode ID)

1. For the conditions, sequences and modes tested, the BAS, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

J. Sampling Strategy for Identical Units

1. Sample 10% of the field panels for procedure 9, and 10% of the local ports for procedure 12. If 10% fail, test another 10%. If 10% of those fail, test all remaining units at the contractor's expense.

3.04 EXHAUST FANS

A. The testing requirements apply to the following fans (check all that apply): central restroom, mechanical room.

B. Parties Responsible to Execute Functional Test

1. Temperature Controls Contractor: operate the controls to activate the equipment, if BAS controlled.

2. CA: to witness, direct and document testing.

C. Integral Components or Related Equipment Being Tested

	Construction Checklist ID
1. Exhaust fans	PC-_____

D. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

E. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both[1]	Required Seasonal Test
General 1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unnoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Verify schedules and setpoints to be reasonable and appropriate		
3. Function at fire alarm (off, depressurization, etc.)	Manual	
4. Interlocks to building pressurization control	Manual	
5. Speed controls	Either	
6. Check TAB report record of sound power level tests and space pressures and compare to specifications	Review	
7. Sensor calibration checks on any controlling temperature or pressure sensor	Manual	

[1]Refer to Special Procedures

F. Special Procedures (other equipment to test with, etc.; reference to function ID) None

G. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the Temperature Controls Contractor. Other points shall be monitored by the CA using dataloggers. Refer to the Monitoring section at the beginning of Section 15997 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each fan:					
Do be determined					

Remarks:

H. Acceptance Criteria (referenced by function or mode ID)

1. 1-6. For the conditions, sequences and modes tested, the fans, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

I. Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

1. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

3.05 INDOOR AIR CLIMATE CONTROL--MISC. SYSTEMS

A. At least 10% of all space zones shall be verified to be maintaining proper climate control. Specific test requirements for this may have been identified elsewhere in this specification (e.g., under terminal units). For all areas not specifically specified, otherwise, the following tests shall be conducted.

B. Parties Responsible to Execute Functional Test

1. Temperature Controls Contractor: operate the controls and provide trend logs

2. CA: to witness, direct and document testing.

C. Integral Components or Related Equipment Being Tested

1. Cooling plant (entire system)
2. Heating plant (entire system)
3. Air, water distribution system
4. Control system

D. Prerequisites All listed systems in Part B, above, shall have had successful functional tests completed prior to this test.

E. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

This is a performance test to verify that the HVAC systems can provide and maintain the temperature and relative humidity levels specified, during normal and extreme weather and occupancy conditions. The test consists of monitoring, via trend logs, of various points during the cooling season when temperatures reach to within 5°F of season design (ASHRAE 2 1/2%).

F. Special Procedures (other equipment to test with, etc.; reference to function ID)

1. Building should be normally occupied during the test.

G. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the Temperature Controls Contractor. Refer to the Monitoring section at the beginning of Section 15997 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
Space temperature control:					
Space temperature	5	5 days incl. weekend	Y	Y	1-3
OSAT-DB	5	5 days incl. weekend	Y	Y	1-3

Remarks:

H. Acceptance Criteria (referenced by function or mode ID)

1. Space temperature during occupied modes shall average within +/- 1°F of set point and always remain within 1°F of the ends of the dead band without excessive hunting of either the applicable damper or coil valve, or complaints of drafts or stuffiness from occupants.

I. Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

1. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

3.06 SERVICE HOT WATER SYSTEM

A. Parties Responsible to Execute Functional Test

1. CA: perform and document testing.

B. Integral Components or Related Equipment Being Tested

Construction Checklist ID

1. Hot water heaters (heaters, mixing valves) PC-_____

2. Recirculating pumps PC-_____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The

commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test
General 1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unnoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Verify schedules and setpoints to be reasonable and appropriate		
3. Unoccupied pump operation	Either	
4. Mixing valve operation and temperature control	Either	
5. Sensor calibration checks on hot water temperature	Manual	

E. Special Procedures (other equipment to test with, etc.; reference to function ID) None

F. Required Monitoring None

G. Acceptance Criteria (referenced by function or mode ID)

1. 1-6. For the conditions, sequences and modes tested, the fan's integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

H. Sampling Strategy for Identical Units

1. No sampling. Test all units.

3.07 TERMINAL UNITS

(This applies to standard applications, critical applications will have additional tests and a higher fraction tested.)

A. Parties Responsible to Execute Functional Test

1. Temperature Controls Contractor: operate the controls to activate the equipment.

B. Integral Components or Related Equipment Being Tested

	Construction Checklist ID
1. Terminal unit (TU)	PC-_____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The

commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

D. Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements

The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both[3]	Required Seasonal Test[1]
General 1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, warmup, shutdown, unnoccupied & manual modes and power failure and restoration. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with, including all damper, valve and fan functions.	Manual	
In addition to, or as part of (1) above, the following modes or tests are required:		
2. Sensor activator calibration checks on: SAT, MAT, zone air temperature damper position and other random checks (EMS readout against visual or hand-held calibrated instrument must be within 0.5°F for temps. or within a tolerance equal to 10% of static pressure setpoint, with an inclined manometer)	Manual	
3. Device and actuator calibration and stroke checks for heating coil valve and non-DDC dampers	Manual	
4. For the TU's tested, check the construction checklist items.	Observation	
5. Verify control parameters and setpoints to be reasonable and appropriate by reviewing the full program of 5% of all the TU's with each other for consistency. Verify the max. and min. cfm setpoints of all tested TU's against the control drawing and TAB values. Verify other TU programming parameters such as K-factors, deadbands, setpoints, stroke times, etc.	Observation	
6. Verify no CCV flow when there is HCV flow	Either	
7. Verify no hunting or significant overshoot by damper or valves.	Either	
8. Verify by measurement, CCV & HCV positive shutoff (no leak-thru)	Manual	
9. Verification of minimum OSA control through varying VAV box positions, if applicable	Either	[2]
10. All alarms (fan status, low limits, high static, etc.)	Manual	
11. Verify that TU is maintaining space setpoint temperatures	Monitoring	Both Design
12. Verify airflows and pressures (this random test is part of the TAB test)	--	

NOTES:
[1]Cooling season, Heating season or Both. "Design" means within 5°F of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.
[2]Seasonal test not required if seasonal conditions can be adequately simulated.
[3]Refer to Special Procedures

E. Special Procedures (other equipment to test with, etc.; reference to function ID) None

F. Required Monitoring

1. All points listed below which are control system monitored points shall be trended by the Temperature Controls Contractor. Other points shall be monitored by the CA using dataloggers. Refer to the Monitoring section at the beginning of Section 15997 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)	Function Being Tested
For each zone thermostat and space sensor and other critical areas, monitor:					
Space temperature	10	3 weekdays, summer design	Y	Y	11
Space temperature	10	3 weekdays, winter design	Y	Y	11
Space temperature	2	8 hours, occupied	Y	Y	7
Heating coil valve	2	8 hours, occupied	Y	Y	7
Damper position or cfm	2	8 hours, occupied	Y	Y	7

Remarks:

G. Acceptance Criteria (referenced by function or mode ID)

1. 1-11. For the conditions, sequences and modes tested, the TU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. 10. Space temperature during occupied modes shall average within +/- 1°F of setpoint and always remain within 1°F of the ends of the deadband without excessive hunting of either the damper or coil valve, or complaints of drafts or stuffiness from occupants.

H. Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

1. Testing. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

2. Monitoring. Ten percent of the total number of zones in the building, chosen by the Owner, shall be monitored. Within this 10%, shall be included a distribution of all air handlers, zones expected to have the greatest heating and cooling demand, perimeter and core zones and zones identified from the commissioning process that have exhibited potential problems.

3.08 TEST AND BALANCE WORK (TAB)

A. Parties Responsible to Execute Functional Test

1. TAB contractor: perform checks using test instruments.

2. Temperature Controls Contractor: operate the controls to activate the equipment.

3. CA: to witness, direct and document testing.

B. Integral Components or Related Equipment Being Tested

	Construction Checklist ID
1. TAB water-side	PC-_____
2. TAB air-side	PC-_____

C. Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the construction checklists previously completed by the installer, before the beginning of functional testing.

D. Purpose. The purpose of this test is to spot check the TAB work to verify that it was done in accordance with the contract documents and acceptable practice and that the TAB report is accurate.

E. The following tests and checks will be conducted. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

	Test or Check	Test Method	Required Seasonal Test[3]
	A random sample of up to 25 % the TAB report data shall be selected for verification (air velocity, air or water flow rate, pressure differential, electrical or sound measurement, etc.). The original TAB contractor will execute the checks, witnessed by the commissioning authority. The TAB contractor will use the same test instruments as used in the original TAB work. A failure[1] of more than 10% of the selected items of a given system[2] shall result in the failure of acceptance of the system TAB report and the TAB contractor shall be responsible to rebalance the system, provide a new system TAB report and repeat random verifications of the new TAB report. The testing will include the verification of minimum outdoor air intake flows at minimum, maximum and intermediate total airflow rates for 100% of the air handlers. Other selected data to be verified will be made known upon day of testing.	Demonstration	
2.	Verify that final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked by the TAB Contractor.	Demonstration	

3.	Verification that the air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all TUs taking off downstream of the static pressure sensor, the TU on the critical leg has its damper 90% or more open.	Demonstration	
4.	Verification that the water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90% or more open.	Demonstration	

[1]Failure of an item is defined as follows:

For air flow of supply and return: a deviation of more than 10% of instrument reading

For minimum outside air flow: 20% of instrument reading (30% for reading at intermediate supply flow for inlet vane or VFD OSA compensation system using linear proportional control)

For temperatures: a deviation of more than 1°F

For air and water pressures: a deviation of more than 10% of full scale of test instrument reading

For sound pressures: a deviation of more than 3 decibels. (Variations in background noise must be considered)

[2]Examples of a "system" are: the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system. Systems can be defined smaller if inaccuracies in TAB work within the smaller defined system will have little or no impact on connected systems.

[3]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

F. Special Procedures (other equipment to test with, etc.; reference to function ID) None

G. Required Monitoring None

H. Acceptance Criteria (referenced by function or mode ID)

1. Provided in footnote to test table above.

I. Sampling Strategy for Identical Units

1. Described in test table above.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230593 – HVAC TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Scope: Extent of HVAC testing, adjusting and balancing work required by this Section is indicated on the drawings, in schedules, and by the requirements of this Section.

B. Testing, Adjusting and Balancing (TAB) contractor to meet or exceed all uniform code testing requirements. (e.g. ASHRAE, ASME, IMC, Etc.)

C. Systems: Testing, adjusting and balancing specified in this Section includes the following systems:

1. Air systems including supply, return and exhaust.
2. Hydronic systems including heating, chilled water.

D. Related Sections: Refer to other Division 23 sections for:

1. Fans
2. Air Terminal Units
3. Pumps
4. Hydronic Piping Systems
5. Ductwork
6. Boilers
7. Chillers and Cooling Towers

1.02 QUALITY ASSURANCE

A. Agency Qualifications

1. The qualifications of the TAB contracting firms shall be submitted, within 30 days of notice to proceed. Recent projects shall be listed and described for the company. Names and telephone numbers of the project contractors and facility managers will be provided.

2. The Owner must approve in writing the qualifications of both the company and the lead technician.

3. Qualifications of TAB Firm Personnel:

a. A minimum of one professional engineer with current registration is required to be in the permanent employment of the firm for supervision and direction in the work performed. This engineer shall be totally responsible for developing job site data as required for test procedures.

b. All personnel used on job site shall be either professional engineer or technicians, who shall have been permanent, full-time employees of firm for a minimum of six (6) months prior to start of work for that specified project.

c. The qualifications of the TAB lead site technician who will remain on site during all TAB work, within 30 days of notice to proceed. Recent projects shall be listed and described for the company. Names and telephone numbers of the project contractors and facility managers will be provided.

d. The Owner must approve in writing the qualifications of both the company and the lead technician.

B. Tester's Qualifications: A specialist certified by the National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) with at least 3 years of experience in those testing, adjusting and balancing requirements similar to those required for this project, who is not the installer of the system to be tested and is otherwise independent of the project.

C. Codes and Standards: Provide testing, adjusting and balancing conforming to American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), American National Standards Institute (ANSI), and either NEBB or AABC the following:

1. American National Standards Institute (ANSI): Comply with the following:

a. S1.4Specification For Sound Level Meters
b. S1.11Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters

2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing.

3. NEBB or AABC: Comply with NEBB'S "Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems" or comply with AABC MN-1 "National Standards," as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.

D. Calibration of Testing Instruments: All measurement instruments used for testing, adjusting, balancing, and commissioning shall be calibrated. The time between the most recent calibration data and the final test report date shall not be over 1 year.

1.03 SUBMITTALS

A. Test Reports: Provide certified test reports, signed by the test and balance supervisor who performed the work. The final reports shall include identification and types of instruments used, and their most recent calibration date and calibration date.

B. Standards: Deliver a copy of either NEBB or AABC standards for testing and balancing work associated with the project. This document shall serve as specific guidance to balancers as to minimum requirements.

C. Maintenance Data: Include, in maintenance manuals, copies of balance test reports and identification of instruments.

D. Qualifications: Submit the individual qualifications of all persons responsible for supervising and performing the actual work.

1.04 AGENDA

A. Agenda: A preliminary report and agenda shall be submitted and approved prior to the start of testing and balancing work.

1. Review Drawings and Specifications prior to installation of any of the affected systems, and submit a report indicating any deficiencies in the systems that would preclude the proper adjusting, balancing, and testing of the systems.

2. The agenda shall include a general description of each air and water system with its associated equipment and operation cycles for heating, intermediate, and cooling.

3. The agenda shall include a list of all air and water flow and air terminal measurements to be performed.

4. The agenda shall incorporate the proposed selection points for sound measurements, including typical spaces as well as sound sensitive areas.

5. The agenda shall also include specific test procedures and parameters for determining specified quantities (e.g. flow, drafts, sound levels) from the actual field measurements to establish compliance with contract requirements. Samples of forms showing application of procedures and calculations to typical systems shall be submitted.

6. Specific test procedures for measuring air quantities at terminals shall specify type of instrument to be used, method of instrument application (by sketch) and factors for:

    a. Air terminal configuration.
    b. Flow direction (supply or exhaust).
    c. Velocity corrections.
    d. Effective area applicable to each size and type of air terminal.
    e. Density corrections.

7. The agenda shall include identification and types of measurement instruments to be used, and their most recent calibration date and calibration date.

1.05 JOB CONDITIONS

A. General: Do not proceed with testing, adjusting and balancing work until the following conditions have been met.

1. Work has been completed and is operable. Ensure that there is no latent residual work yet to be completed on the tested equipment.

2. Work scheduled for testing, adjusting and balancing is clean and free from debris, dirt and discarded building materials.

3. All architectural openings (doors, windows, and other openings) which may affect the operation of the system to be tested, adjusted, and balanced shall at their normal states.

4. All related mechanical systems which may affect the operation of the system to be tested, adjusted, and balanced shall be at their normal operating conditions. Coordinate tests with Controls Contractor.

5. Air handling unit filters are not "loaded"; Mechanical Contractor shall replace, if required, prior to balancing.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

A. Material: Seal, patch and repair ductwork, piping and equipment drilled or cut for testing purposes.

1. Plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.

2. Piping shall be capped with materials the same as the piping system.

3. Insulation shall be neatly hemmed with metal or plastic.

2.02 TEST INSTRUMENTS

A. Standards: Utilize instruments and equipment of type, precision, and capacity as recommended in the following standards:

1. NEBB "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

2. AABC Manual MN-1, "AABC National Standards".

B. Test Instruments: All instruments used for measurements shall be accurate and calibration histories for each instrument shall be available for examination. Each test instrument shall be calibrated by an approved laboratory or by the manufacturer. Owner's representative has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of readings is questionable.

C. Additional Instruments: Permanently installed measuring instruments, such as temperature and pressure gauges, shall be checked against transfer standard instruments. Any instrument which does not meet specification requirement shall be replaced or recalibrated.

D. Cone Instruments: Employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser air flow measurements. The readout meters shall meet calibration requirements.

PART 3 - EXECUTION

3.01 PROCEDURES AND INSTRUMENTS, GENERAL

A. Requirements: All systems and components thereof shall be adjusted to perform as required by drawings and specifications.

B. Test Duration: Operating tests of heating and cooling coils, fans, and other equipment shall be of not less than four hours duration after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.

C. Instrumentation: Method of application of instrumentation shall be in accordance with the approved agenda.

1. All instruments shall be applied in accordance with the manufacturer's certified instructions.

2. All labor, instruments, and appliances required shall be furnished by the balancer. Permanently installed instruments used for the tests (e.g., flow meters and Btu meters) shall not be installed until the entire system has been cleaned and ready for operation.

3.02 AIR SYSTEM PROCEDURES

A. Adjustments: Adjust all air handling systems to provide approximate design air quantity to or through, each component, and to maintain stable and comfortable interior temperatures, free of drafts or stagnant conditions. Adjusting and balancing of all systems shall be conducted during periods of the year approximating maximum seasonal operation. Verify operating parameters prior to start of balancing. Laboratory doors shall be closed and fume hood sashes full open, and all

other ancillary systems in simultaneous operation. Coordinate with automatic control system operation.

B. Balance: Flow adjusting (volume control) devices shall be used to balance air quantities (i.e., proportion flow between various terminals comprising system) to the extent that their adjustments do not create objectionable air motion or sound (i.e., in excess of specified limits).

1. Balancing between runs (submains, branch mains, and branches) generally shall be accomplished by flow regulating devices at, or in, the divided-flow fitting.

2. Restriction imposed by flow regulating devices in or at terminals shall be minimal. Final measurements of air quality shall be made after the air terminal has been adjusted to provide the optimum air patterns of diffusion.

C. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds or axial-flow fan wheel blade pitch. Damper restriction of a system's total flow may be used only for systems with direct-connected fans (without adjustable pitch blades), provided system pressure is less than 1/2-inch W.G. and sound level criteria is met.

D. Air Measurement: Where air quantity measuring devices are specified in other sections such systems shall be used as a cross-check of portable measuring equipment.

1. Except as specifically indicated herein, pitot tube traverses shall be made of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform to the ASHRAE "Handbook Fundamentals Inch Pound Edition."

2. For ducts serving modular office areas with movable partitions, which are subject to change, pitot tube traverses may be omitted provided the duct serves only a single room or space and its design volume is less than 2000 cfm. In lieu of pitot tube traverses, air flow in the duct shall be determined by totalling volume of individual terminals served, measured as described herein.

3. Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.

E. Test Holes: Test holes shall be in a straight duct, as far as possible downstream from elbows, bends, take-offs, and other turbulence generating devices, to optimize reliability of flow measurements.

F. Air Terminal Balancing: Generally, measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing. Measurement of air quantities at each type of air terminal (inlet and outlet) shall be determined by the method approved for the balancing agenda.

G. Air Motion: Air motion and distribution shall be as specified and indicated on Drawings.

3.03 WATER SYSTEM PROCEDURES

A. Adjustment: All heating, cooling and condensing water systems shall be adjusted to provide required quantity to or through each component. Verify operating parameters prior to start of balancing.

B. Metering: Water quantities and pressures shall be measured with calibrated meters.

1. Venturi tubes, orifices, or other metering fittings and pressure gauges shall be used to measure water flow rates and balance systems. Systems shall be adjusted to provide the approved

pressure drops through the heat transfer equipment (coils [except room units], converters, etc.) prior to the capacity testing.

2. Where flow metering fittings are not installed, in air/water type heat transfer equipment, flow balance shall be determined by measuring the air side energy differential across the heat transfer equipment. Measurement of water temperature differential shall be performed with the air system, adjusted as described herein, in operation.

C. Automatic Controls: Automatic control valves shall be positioned for full flow through the heat transfer equipment of the system during tests.

D. Flow: Flow through bypass circuits at three-way valves shall be adjusted to equal that through the supply circuit, when the valve is in the bypass position.

E. Distribution: Adjustment of distribution shall be effected by means of balancing devices (cocks, valves, and fittings) and automatic flow control valves as provided; service valves shall not be used.

1. Where automatic flow control valves are utilized in lieu of Venturi tubes, only pressure differential need be recorded, provided that the pressure is at least the minimum applicable to the tag rating.

F. Special Procedures: Where available pump capacity (as designed) is less than total flow requirements of individual heat transfer units of system served, full flow may be simulated by the temporary restriction of flow to portions of the system; specific procedures shall be delineated in the agenda.

3.04 HEAT EXCHANGER CAPACITY VERIFICATION

A. Air coil capacities shall be verified from air side measurement data. Capacities of coils shall be the difference of the energy carried by the air between the up stream and down stream of the coils.

B. The measured air flow rate for the fan may be used for air coil capacity calculations providing no ducted bypassing of coil is occurring.

C. Capacity verifications shall be performed after air and water systems have been balanced. Heat exchangers using steam as the exchange medium shall have the steam measured and adjusted to the specified pressure.

D. False load shall be applied if the upstream air or water does not meet the specified conditions at the time of test.

3.05 REPORTS

A. Submittals: Three copies of the reports described herein, covering air and water system performance, air motion (fpm), and sound pressure levels, shall be submitted prior to final tests and inspection.

B. Instrument Records: Types, serial numbers, and dates of calibration of all instruments shall be included.

C. Reports: Reports shall conspicuously identify items not conforming to contract requirements, or obvious malfunction and deficiencies.

3.06 AIR SYSTEM DATA

A. Report: The report shall include for each air handling system the data listed below.

1. Equipment (Fan or Factory Fabricated Station Unit):

    a. Installation data

        1) Manufacturer and model
        2) Size
        3) Arrangement, discharge and class
        4) Motor hp, voltage, phase, cycles, and full load amps
        5) Location and local identification data

    b. Design data

        1) Data listed in schedules on drawings and specifications.

    c. Fan recorded (test) data

        1) cfm
        2) Static pressure
        3) rpm
        4) Motor operating amps motor operating bhp

2. Duct Systems:

    a. Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust

        1) Duct size(s)
        2) Number of Pitot tube (pressure measurements)
        3) Sum of velocity measurements (Note: Do not add pressure measurements)
        4) Average velocity
        5) Recorded (test) cfm design cfm

    b. Individual air terminals

        1) Terminal identification supply or exhaust, location and number designation
        2) Type size, manufacturer and catalog identification applicable factor for application, velocity, area, etc., and designated area
        3) Design and recorded velocities- fpm (state "core," "inlet," etc., as applicable)
        4) Design and recorded quantities -cfm deflector vane or diffusion cone settings

3.07 WATER SYSTEM DATA

A. Report: The certified report for each water system shall include the data listed below.

1. Pumps:

    a. Installation data

        1) Manufacturer and model
        2) Size
        3) Type drive
        4) Motor hp, voltage, phase, and full load amps

    b. Design data

        1) gpm

2) Head
3) rpm, bhp, and amps

c. Recorded data

1) Discharge pressures (full-flow and no-flow)
2) Suction pressures (full-flow and no-flow) operating head
3) Operating gpm (from pump curves if metering is not provided) no-load amps (where possible)
4) Full-flow amps
5) No-flow amps

2. Air Heating and Cooling Equipment:

a. Design data

1) Load in Btu or MBh
2) gpm
3) Entering and leaving water temperature
4) Entering and leaving air conditions (DB and WB)

b. Recorded data

1) Type of equipment and identification (location or number designation)
2) Entering and leaving air conditions (DB and WB)
3) Entering and leaving water temperatures

3. Water Chilling Units:

a. Installation data

1) Manufacturer and model
2) Motor hp, voltage, cycles, phase, and full load amps
3) Part load amperes
4) gpm - chiller and condenser
5) Water pressure drop - chiller and condenser
6) Entering and leaving water temperature - chiller and condenser

b. Recorded data (chiller and condenser)

1) gpm
2) Water pressure drop
3) Entering and leaving water temperature
4) Amperes

3.08 FINAL COMMISSIONING TESTS, INSPECTIONS AND ACCEPTANCE

A. Scope: Test shall be made to demonstrate that capacities and performance of air and water systems comply with contract requirements.

1. At the time of final inspection, recheck random selection of data (water and air quantities, air motion, and sound levels) recorded in the balancing report. All laboratories shall be rechecked for satisfactory air flow and motion on vicinity of and through hoods.

2. Points and areas for recheck shall be selected by the Owner's Representative.

3. Measurement and test procedures shall be the same as approved for work forming basis of certified report.

4. Selections for recheck (specific plus random), in general, will not exceed 25 percent of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.

B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more greater than, that recorded in the report listings, as 10 percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made, all at no additional cost.

C. Marking of Settings: Following final acceptance of balance reports, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230680 – FIRE STOPPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in/ joints between fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested fire stop systems shall be used in specific locations as follows:

1. Penetrations for the passage of ductwork, cable, cable tray, conduit, piping, electrical bus ways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

B. Safing slot gaps between edge of floor slabs and curtain walls.

C. Openings between structurally separate sections of wall or floors.

D. Gaps between the top of walls and ceilings or roof assemblies.

E. Expansion joints in walls and floors.

F. Openings and penetrations in fire-rated partitions or walls containing fire doors.

G. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 033000 – Cast-In-Place Concrete Work
2. Section 042000 – Unit Masonry
3. Section 079200 – Joint Sealants
4. Section 092300 – Gypsum Plaster
5. Section 092900 – Gypsum Wall Board
6. Section 230300 – Mechanical Basic Materials and Methods
7. Section 230700 – HVAC Insulation

1.05 REFERENCES

A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Fire stop Devices (XHJI)
b. Fire Resistance Ratings (BXUV)
c. Through-Penetration Fire stop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)

2. Alternate “Omega Point Laboratories Directory” (updated annually)

C. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems” (July 1998.)

D. Test Requirements: ASTM E 1966-01, “Standard test method for Fire Resistive Joint Systems”

E. Inspection Requirements: ASTM E 2174 – 01, “Standard Practice for On-site Inspection of Installed Fire Stops.”

F. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

G. ASTM E-84-01, Standard Test Method for Surface Burning Characteristics of Building Materials.

H. All major building codes: ICBO, SBCCI, BOCA, and IBC.

I. NFPA 101 - Life Safety Code

J. NFPA 70 - National Electric Code

1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (Latest Edition varies (2009 – 2018), and may be amended from time to time).

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 13300.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor's name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) and joint systems (XHBN) listed in Volume 2 of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma (or equal) 800-879-8000

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
   a. Add Aerator adaptor when used in conjunction with aerator (“sovent”) system.

2. Hilti CP 681 Tub Box Kit for use with tub installations.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 604 Self-leveling Firestop Sealant
3. Hilti CP 620 Fire Foam
4. Hilti CP 606 Flexible Firestop Sealant
5. Hilti CP 601s Elastomeric Firestop Sealant

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601s Elastomeric Firestop Sealant
2. Hilti CP 606 Flexible Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant

E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti CP 672 Speed Spray
2. Hilti CP 601s Elastomeric Firestop Sealant
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CP 604 Self-leveling Firestop Sealant

F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti CP 677 Speed Plugs
2. Hilti CP 767 Speed Strips

G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant

H. Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire stop Sealant
2. Hilti CP 618 Fire stop Putty Stick
3. Hilti CP 620 Fire Foam
4. Hilti CP 601s Elastomeric Fire stop Sealant
5. Hilti CP 606 Flexible Fire stop Sealant

I. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti CP 618 Fire stop Putty Stick

J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti CP 617 Fire stop Putty Pad

K. Fire stop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 Fire stop Collar
2. Hilti CP 643 Fire stop Collar
3. Hilti CP 645 Wrap Strips

L. Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical bus ways in raceways, the following products are acceptable:

1. Hilti CP 637 Trowelable Fire stop Compound
2. Hilti FS 657 FIRE BLOCK
3. Hilti CP 620 Fire Foam

M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical bus ways in raceways, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK

N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. Hilti CP 672 Speed Spray
2. Hilti CP 601s Elastomeric Fire stop Sealant
3. Hilti CP 606 Flexible Fire stop Sealant
4. Hilti CP 604 Self-Leveling Fire stop Sealant

O. Provide a fire stop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

P. Provide a fire stop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which fire stop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Fire stop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place fire stop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install fire stop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL fire stop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing fire stop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess fire stop materials and soiling as work progresses.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230700 – HVAC INSULATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Duct Insulation.

B. Pipe Insulation.

C. Equipment and Specialties Insulation.

D. Acoustical Wrap.

1.02 RELATED WORK

A. Division 23 – Mechanical, General

B. Division 23 – Hangers and Supports

C. Division 23 – Sleeves and Seals

D. Division 23 – Pumps

E. Division 23 – Refrigerant Piping System

F. Division 23 – Ductwork

1.03 DEFINITIONS

A. R: Thermal resistance of insulation, in units of hr-sf-deg F/Btu.

B. Run-out: Piping not more than 12 feet long that runs to an individual unit.

C. Subject to Damage: Items installed exposed less than 8 feet above the walking surface (i.e., floor platform, roof, grade, etc.) adjacent to the item.

1.04 QUALITY ASSURANCE

A. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84, NFPA 255, and UL 723.

1.05 SUBMITTALS

A. All submittals shall comply with Section 230000.

B. Provide product data on all insulation materials to be used. Indicate thickness to be used.

1.06 GENERAL REQUIREMENTS

A. Code Compliance: Contractor shall insulate all systems with the materials and thicknesses as required by code, but in no case shall the insulation be less than that specified herein. In some cases the specified insulation exceeds code, and shall be provided as specified. Not all systems

requiring insulation by code are specified but shall be provided with insulation where required by code.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems (except ductwork). Inserts at hangers are specified in Section 230300 and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pipe hanger/supports. See Section 230300.

C. All adhesives, sealants, mastics and similar materials shall be low-VOC type and comply with Section 230000 Low-VOC requirements.

1.07 REFERENCES

A. ASTM A 653: Standard Specification For Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

B. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C 547: Standard Specification for Mineral Fiber Pipe Insulation.

D. ASTM C 1136: Standard Specifications for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

E. ASTM C 1290: Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

F. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

G. NCIIS: National Commercial & Industrial Insulation Standards, published by Midwest Insulation Contractors Association, 5th Edition.

H. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials.

I. UL 723: Tests For Surface Burning of Building Materials.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230000.

B. Insulation: Johns Manville, Armacell, Owens-Corning, Knauf, Pittsburgh Corning, GLT, Halstead, Thermal Pipe Systems.

C. Accessories: Johns Manville, Armacell, Owens-Corning, Knauf, Pittsburgh Corning, GLT, Halstead, Duro Dyne, Gustin Bacon, Childers, RPR, Tee Cee, JPS, Buckaroos.

D. Acoustical Wrap: Kinetics Noise Control.

E. Fire Protection Duct Wrap: 3M.

2.02 DUCT INSULATION

A. Flexible Glass Fiber:

B. Material: Inorganic glass fibers, bonded with a thermosetting resin.

C. Jacket: All-purpose, factory-applied, laminated glass-fiber- reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

D. Board: ASTM C 612, Class 2, semi-rigid jacketed board.

1. Thermal Conductivity: 0.23 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.

2. Density: 3 pcf average maximum.

E. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets. (maximum 25% compression installed)

1. Thermal Conductivity: 0.23 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.

F. Adhesive: Produced under the UL Classification and follow-up service.

1. Type: Non-flammable, water-based.
2. Service Temperature Range: Minus 20 to 180 deg F (Minus 29 to 82 deg C).

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.03 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, pre-sized a minimum of 8 ounces per sq. yd.

1. Tape Width: 4 inches
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch thick.
2. Aluminum: 0.0070 inch thick.

C. Wire: 14-gauge nickel copper alloy, 16-gauge, soft-annealed stainless steel, or 16-gauge, soft annealed galvanized steel.

D. Corner Angles: 28-gauge (0.3 mm), 1 inch by 1 inch (25 mm by 25 mm) aluminum, adhered to 2 inches by 2 inches (51 mm by 51 mm) kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.04 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm maximum.
2. Temperature Range: Minus 20 to 180 deg F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.

1. Water Vapor Permeance: 0.02 perm maximum.
2. Temperature Range: Minus 50 to 250 deg F.
3. Cooler: Aluminum.

C. Duct Insulation installed R values:

1. General: Provide insulation densities and thicknesses to achieve the following R values. R values are for the insulation only, in their installed thickness, considering installed duct wrap stretch and in accordance with code.

2. Lining: Where ducts have internal lining, the insulating properties of the lining may be credited toward meeting the required insulation R value.

3. Supply Air Ductwork:

a. Inside Building and within conditioned space: No insulation required.

b. Inside Building but not within conditioned space: R-6.

4. Return Air Ductwork:

a. Inside Building and within conditioned space: No insulation required.

b. Inside Building but not within conditioned space: R-6.

5. Outside Air Ductwork: Same insulation for ducts within conditioned space: R-8.

6. Exhaust and Relief Ductwork:

a. Inside Building and within conditioned space: No insulation required except ductwork from the system's backdraft damper (or motorized damper) to outside the building shall be insulated with R-8 insulation.

b. Inside Building but Not within conditioned space: R-6.

2.05 PIPE INSULATION

A. Glass Fiber:

1. Type: Rigid molded type, constructed of glass fibers bonded by a thermosetting resin, complying with ASTM C 1290, Type III. Insulation factory molded to match pipe size applied to. Johns Manville "Micro- Lok" (or approved).

2. Jacket: ASJ type, vapor proof, consisting of a white kraft paper cover reinforces with glass fiber and bonded to aluminum foil, with longitudinal self-sealing closure system. Provide with butt strips constructed of jacket material with adhesive to seal all joints. Water vapor permeance shall not exceed 0.02 perms.

3. Thermal Conductivity: Shall not exceed 0.24 Btu-in/hr-sq ft-deg F at 75° F.

4. Operating Temperature Limits: 0° F to 850° F.

B. Elastomeric Insulation:

1. Type: Flexible cellular elastomeric insulation, factory formed to match pipe sizes applied to, complying with ASTM C 534, Type 1. Armacell “AP/Armaflex SS”, Armaflex Shield (or approved equal).

2. Thermal Conductivity: Shall not exceed 0.27 Btu-in/hr-sq ft-deg F at 75° F.

3. Water Vapor Transmission: Water vapor permeance shall not exceed 0.08 perms.

4. Operating Temperature Limits: -20° F to 180° F.

5. Weather Protection: Where installed outdoors provide Zeston 2000 PVC cover.

C. Pipe Fittings:

1. Insulate with mitre cut or premolded fitting insulation of same material and thickness as pipe insulation.

D. Pipe Insulation Types:

1. Aboveground-Inside Building:

a. Hydronic Piping Systems: Glass fiber.

b. Cooling Coil Condensate: Glass fiber or elastomeric.

c. Refrigerant Piping: Elastomeric.

d. Other Systems: Glass fiber.

E. Pipe Insulation Thickness:

COLD SERVICE INSULATION MATERIAL SCHEDULE

TYPE	SERVICE AND TEMPERATURES	INSULATION MATERIAL	PIPE SIZES (INCHES)	MINIMUM (NOMINAL) INSULATION THICKNESS (INCHES)
A & B	Refrigerants, Brine, and Fluids below 40 F.	Flex. Elastomeric Foam	Less than 8 8 and Up	1 1-1/2
C	Chilled Water, domestic cold water, and other fluids 40 F to 80 F.	Flex. Elastomeric Foam or Fibrous Glass	All sizes	1

HOT SERVICE INSULATION MATERIAL SCHEDULE

	SERVICE AND TEMPERATURES	INSULATION MATERIAL	PIPE SIZES (INCHES)	MINIMUM (NOMINAL) INSULATION THICKNESS (INCHES)
D	Domestic Hot water, Domestic Hot Water recirculating, and other fluids 105 F to 140 F.	Flex. Elastomeric Foam or Fibrous Glass	Less than 1-1/2 1-1/2 &over	1 1-1/2
E	Heating hot water, and other fluids 141 F to 200 F.	Fibrous Glass	Less than 1-1/2 2 &over	1-1/2 2
F	Steam (LPS) to 15 psig 201 F-250 F	Fibrous Glass	Less than 4 4 & Up	2-1/2 3
G	Water and other fluids 251 F to 350 F.	Fibrous Glass	Less than 1 1 & Up	2 4-1/2
H	Water and other fluids Above 350 F.	Fibrous Glass	Less than 1 1 & Up	4-1/2 5

1. Provide minimum piping insulation thickness indicated, in inches.
2. Where a system operates over temperature ranges calling for different insulation thicknesses, the thicker insulation requirements shall be met.
3. Cooling system condensate piping (i.e., from a cooling coil) shall be considered to operate at 53° F.
4. Refrigerant piping (RG or RS piping) returning from an evaporator (i.e., cooling coil) to a compressor shall be considered to operate at 40° F.
5. Outdoor Piping: Piping exposed to outside air or located outside the building/thermal envelope, shall have insulation thickness increased by 0.5 inch from that indicated above.
6. Hydronic heat pump piping shall be considered to operate at 120° F (unless noted otherwise).
7. Cold water piping shall be considered to operate at 56° F (unless noted otherwise).

F. Underground piping:

1. Underground chilled water and hot water:

a. All underground pre-insulated pipe 1 1/2” – 12” shall be similar to thermal pipe systems, inc. heat-tite® piping with ring-tite joints.

b. Steel carrier pipe shall be black steel of the type, grade, and class specified by the design engineer. the pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 250ºf.

c. Each joint shall automatically provide for expansion and contraction through the ethylene propylene diene monomer (epdm) sealing rings in the grooves of the pre-insulated ductile iron coupling.

d. Casing pipe shall be [polyvinyl chloride (pvc) meeting the minimum classification requirements of astm d-1784] or [high density polyethylene (hdpe)]. the thickness shall be in accordance with the thermal pipe systems published data.

e. The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal.

f. The rubber end seals shall be an ethylene propylene diene monomer (epdm) heat resistant compound.

g. Fittings may be uninsulated using welded steel or ductile iron class 150 fitting with a groove and rubber ring. fittings may also be pre-insulated by thermal pipe systems, inc. using the same carrier pipe, insulation thickness, and casing as the straight lengths of pipe.

h. After completion of hydrostatic testing, joints shall be closed using factory supplied 30 mil high temperature tape. it shall be applied circumferentially around the seam between the coupling and pipe casing.

2. Underground steam and steam condensate piping:

a. All underground pre-insulated steam and condensate pipe 3” – 12” shall be similar to thermal pipe systems, inc. super temp-tite® piping with ring-tite joints.

b. Steel carrier pipe shall meet the requirements of astm a-53 or a-106, grade b. each end of the carrier pipe shall be machined and metalized to provide a non-corrosive surface for the sealing rings. the metalizing shall be high nickel alloy applied to an excess thickness and then machined to the required outside diameter.

c. Each joint shall automatically provide for expansion and contraction through the sealing rings in the grooves of the bronze joining coupling. the sealing rings shall be stainless steel spring loaded molded and machined teflon. pipe must be assembled with the lubricant supplied by thermal pipe systems, inc.

d. Casing pipe shall be fiberglass reinforced thermosetting resin pipe (rtrp) manufactured by a filament winding process. the pipe shall be wound to meet astm d2310 classified rtrp-12e.

e. The composite insulation shall be a twocomponent system. the initial insulation shall be calcium silicate satisfactory for temperatures to 1200ºf and shall conform to astm c-533 and mil spec mil-1-2781. the secondary insulation shall be polyurethane foam completely filling the void between the calcium silicate and casing.

f. The rubber end seals shall be a highly saturated hitrile (hsn) or ethylene propylene diene monomer (epdm) heat resistant compound.

g. Fittings shall be pre-insulated by thermal pipe systems, inc. using the same carrier pipe, insulation thickness, and casing as the straight lengths of pipe.

2.06 EQUIPMENT AND SPECIALTIES INSULATION

A. Flexible Glass Fiber:

1. Type: Flexible blanket insulation, constructed of inorganic glass fibers bonded by a thermosetting resin, complying with ASTM C 553, Type III. Johns Manville “812 Spin-Glas” (or approved).

2. Jacket: FSK type, vapor proof, consisting of an aluminum foil cover reinforces with glass fiber mesh, and laminated to kraft. Water vapor permeance shall not exceed 0.05 perms. Provide with joint sealing tape constructed of jacket material with adhesive to seal all joints.

3. Thermal Conductivity: Shall not exceed 0.24 Btu-in/hr-sq ft-deg F at 75° F.

4. Operating Temperature Limits: 40° F to 450° F.

5. Density: 1.5 lb/cu ft.

B. Elastomeric:

1. Type: Flexible cellular elastomeric insulation, complying with ASTM C 534, Type II.

2. Thermal Conductivity: Shall not exceed 0.30 Btu-in/hr-sq ft-deg F at 75° F.

3. Water Vapor Transmission: Water vapor permeance shall not exceed 0.08 perms.

4. Operating Temperature Limits: -20° F to 220° F.

5. Weather Protection: Where installed outdoors provide with manufacturer’s weather proof coating to protect from UV and weather exposure.

C. Removable Insulation Blankets:

1. Type: Flexible blanket insulation pads, for insulating valves, unions, strainers, and similar items. Constructed of exterior fabric enclosure sewn around interior insulation, held in position with a closure system that allows for removal of the blanket. Contractor or factory fabricated.

2. Enclosure:

a. Hot Applications: Glass fiber mat, ¼ inch thick, noncombustible, service temperature up to 1200° F. JPS Glass Fabrics “Glastex 2025” (or approved).

b. Cold Application: Silicone impregnated glass fiber cloth, water resistant, ¼ inch thick. Claremont “Claretex SL” (or approved).

3. Insulation: Thermal insulating wool, 1-inch thick, complying with ASTM C 553. Maximum thermal conductivity 0.22 Btu-in/hr-sq ft-deg F at 75° F. Provide in layers to give equivalent R value to the adjacent insulated piping. Owens Corning “Fiberglass Brand TIW, Type II”.

4. Closure System: Steel lacing anchors with spindles and self-locking washers, fabricated of minimum 14 gauge stainless steel, with stainless steel wire ties. AGM Industries “Series NLA” (or approved).

D. Metal Jacket:

1. Steel: Minimum 24 gauge galvanized steel complying with ASTM A 653. Provide with longitudinal slip joints and 2-inch laps.

2. Aluminum: Minimum 0.020-inch thick aluminum, alloy 3003 or 5005, complying the ASTM B 209. Provide with longitudinal slip joints and 2- inch laps.

E. Equipment and Specialties Insulation Types and Thickness:

1. Unless a specific type of insulation is specified or noted, any of the insulation materials specified in this specification section may be used provided such application is in conformance with NCIIS.

2. Insulation Thickness: Insulation thickness shall be the same as that specified for the piping or ductwork connected to item, or as specified for the system the item is installed in (unless noted otherwise). Insulation thickness shall in no case be less than 1 inch thick.

3. Valves:

a. 2 inches and Smaller: Insulate with same material as piping system.

b. 2-1/2 inches and Larger: Removable blanket insulation.

4. Control Valves: Removable blanket insulation.

5. All equipment and specialties where access is required shall have removable insulation blankets; other removable insulation materials per NCIIS may be used where pre-approved by the Engineer. Items requiring such removable insulation include, but are not limited to, the following:

a. Strainers.

b. Pumps.

c. Balancing valves.

d. Pressure/temperature/flow measuring devices.

e. Pump suction diffusers.

f. Heat exchanger heads.

2.07 ACCESSORIES

A. Adhesive, Caulks, Mastics, and Coatings: As recommended by insulation material manufacturer and suited for the application.

B. Bands: ½ inch wide, of stainless steel, galvanized steel, or aluminum construction, to match with materials used with.

C. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor- discharge welding and galvanized speed washer. Pin length shall be as required for insulation thickness used with. Welded pin holding capacity 100 lb., for direct pull perpendicular to the attached surface. Style and type to suit application.

D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness used with. Adhesive as recommended by the anchor pin manufacturer as appropriate for surface temperatures and materials used with, and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface. Style and type to suit application.

2.08 ACOUSTICAL WRAP

A. Type: Composite material having an outer foil faced sound barrier wrap with an internal sound decoupling insulation. Kinetics Noise Control KNM-100ALQ (or equal).

B. Construction: Outer sound barrier material shall be flexible 1.10 inch think, 1 lb/sf (minimum) barium sulfate loaded limp vinyl sheet, bonded to an outside layer of aluminum foil. Interior sound decoupling insulation shall be 1-inch-thick fiberglass batting quilted to a non-woven porous scrim-coated glass cloth in a 4-inch diamond stitch pattern. Material shall be suitable for temperatures form 40 to 200 degrees F.

C. Acoustic Rating: STC (sound transmission coefficient) 28 (or better).

D. Vibration Damping Material: Kinetics Noise Control KDD or DKC-E-162.

PART 3 – EXECUTION

3.01 GENERAL

A. Pre-Insulation Review: No covering materials shall be applied until systems to be covered have had all tests satisfactorily completed, have had all required inspections, and have been satisfactorily reviewed by the Architect-Engineer. All systems shall be examined by the Contractor to confirm cleanliness and other conditions are appropriate to allow for insulation installation.

B. Insulation Work Review: No insulated items shall be concealed in the building structure or buried until the insulation work has been satisfactorily reviewed by the Architect-Engineer, and has had all required inspections.

C. Standards: Materials shall be installed in accordance with manufacturers' written instructions, NCIIS, and shall comply with materials and methods specified herein. The more stringent requirements govern.

D. Joints/Seams: Joints shall be staggered on multi layer insulation. Locate seams and joints in least visible location.

E. Insulation Protection: Insulation shall be kept clean and dry and shall be protected from dirt, damage, and moisture. Insulation that becomes dirty, damaged, or wet and cannot be restored to like new condition will be rejected, and shall immediately be removed from the jobsite.

F. Insulation Interruptions: Insulation shall be neatly finished at all supports, protrusions and interruptions. Provide adhesive and tape seal to maintain vapor barrier integrity.

G. Equipment and Floor Protection: Cover existing equipment and finished floors to protect such items from insulation fiber and dust. Keep all such existing areas in a "broom clean" condition at the end

of each day. Take precautions in these areas to prevent glass fiber and insulation dust from entering ventilation systems or areas adjacent to the work.

H. Glass Fiber Insulation – General:

1. Finish all insulation ends with joint sealing tape or vapor barrier mastic, no raw edges allowed.

2. Joints: Tightly butt adjacent insulation sections together without any voids. Provide overlap of jacket material over all joints.

I. Items To Be Insulated: Provide insulation on all ductwork, all piping, all items installed in these duct and piping systems, all air and liquid energy conveying systems and components, all air and liquid energy storage, all equipment, and all energy consuming devices specified as part of Division 15, except where such insulation has been specifically excluded.

J. Items Excluded From Being Insulated:

1. Fire Sprinkler piping (except where heat traced).

2. Sanitary sewer drain lines (except traps at handicap accessible fixtures).

3. Factory pre-insulated underground piping.

4. Stops and risers at plumbing fixtures (except at handicap accessible fixtures).

5. Factory insulated water heaters (except for base on electric water heaters).

6. Factory insulated tanks.

7. Electric motors.

8. Fans.

9. Factory insulated or factory lined air handler (heat pumps).

10. Overflow condensate drains.

11. Pumps.

12. Relief valves and associated drain piping.

13. Hose bibs (except where used as drains hot water systems).

14. Water meter.

15. Underground cold water piping and associated underground items.

16. Underground hydronic system piping, 5 feet beyond building foundation wall.

3.02 DUCT INSULATION INSTALLATION

A. Types and Thickness: Insulate all ducts with insulation type and thickness (to provide the required R value listed in this specification.

B. General: Insulation shall be firmly butted at all joints. All longitudinal seams for flexible insulation shall overlap a minimum of 2 inches. All joints and seams shall be finished with appropriate joint sealing tape.

C. Attachment: For rectangular ducts over 24 inches wide, duct insulation shall be additionally secured to the bottom of the ductwork with mechanical fasteners on 18 inch centers to reduce sagging. Washers shall be applied without compressing the insulation. Protruding ends of fasteners shall be cut off flush after washers are installed. All seams, joints, penetrations, and damage to the facing shall be sealed with joint sealing tape or vapor retardant mastic or appropriate joint sealing tape.

3.03 PIPE INSULATION INSTALLATION

A. Types and Thickness: Insulate all piping with insulation type and thickness as specified in “Part 2 – Products”. All piping shall be insulated except where specifically excluded.

B. General: All ends shall be firmly butted together and secured with joint sealing tape. All jacket laps and joint sealing tape shall be secured with outward clinch staples at 4 inch spacing, or by use of a suitable adhesive. Seal all jacket penetrations with vapor barrier mastic.

C. Elastomeric Pipe Insulation: Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. Insulation exposed to weather and not shown to have jacketing shall be protected with UV resistant PVC jacketing as recommended by the manufacturer after the adhesive is dry and cured. A brush coating of adhesive shall be applied to both butt ends to be joined and to both split surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one (1) hour after application. Insulation that can be pulled apart one (1) hour after installation shall be replaced.

D. Pipe Hangers: Provide insulation tight up to pre-insulated pipe supports at pipe hangers; seal all joints with joint sealing tape.

E. Pipe Sleeves: Run insulation continuous full size through sleeve. Coordinate work with fire seal work and confirm fire sealant system is approved for use with insulated pipes; see Division 23.

3.04 EQUIPMENT AND SPECIALTIES INSTALLATION

A. Types and Thickness: All equipment and items installed in insulated duct and piping systems shall be insulated except where specifically noted not to be; reference paragraph 3.01. Insulation type and thickness shall be as specified in “Part 2 – Products”.

B. General: Apply insulation as close as possible to equipment by grooving, scoring, and beveling as necessary. As required, secure insulation to equipment with studs, pins, clips adhesive, wires or bands. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. Comply with NCIIS.

C. Removable: All equipment and specialties where access is required for maintenance, repair, service, or cleaning shall have insulation installed so that it can be easily removed and reinstalled without being damaged and without requiring new insulation.

D. Handicap Lavatories: Insulate P-trap and HW supplies below lavatory where exposed.

E. Nameplates: Do not insulate over nameplate or ASME stamps; bevel and seal insulation around.

F. Jacketing: Provide all equipment with vapor retardant jackets.

3.05 ACOUSTIC WRAP

A. Install in accordance with manufacturers written instruction and NCIIS.

B. On ductwork less than 20 gauge, apply vibration damping material on outside of duct before applying thermal insulation or acoustic wrap.

C. Overlap all interior sound insulation joints with a minimum 2 inch overlap of the exterior sound barrier.

D. Acoustical insulation shall not be compressed.

E. Where installed on ducts requiring thermal insulation, install thermal insulation over acoustic wrap.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230713 – DUCT INSULATION - INTERIOR

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and provisions of contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.02 SUMMARY

A. This section includes duct and plenum insulation.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 23 Section “Ductwork” for duct lining.

1.03 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.

B. Dual-Temperature Surfaces: Normal Operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 75 deg F.

D. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F.

E. Density: Is expressed in lb/cu. ft.

1.04 SUBMITTALS

A. General: Submit the following in accordance with General Conditions of the Contract and Division 01 specification sections.

B. Product and data for each type of duct insulation identifying k-value, thickness, and accessories.

C. Material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

D. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

1.05 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

1.06 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of duct systems.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering 'GREENGUARD' certified products that may be incorporated in the Work include, but are not limited to the following:

1. Glass Fiber:

a. CertainTeed Corporation.
b. Knauf Fiberglass GmbH.
c. Manville.

2.02 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber- reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.

1. Thermal Conductivity: 0.23 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.

2. Density: 3 pcf average maximum.

D. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets. (maximum 25% compression installed)

1. Thermal Conductivity: 0.23 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.

E. Adhesive: Produced under the UL Classification and follow-up service.

1. Type: Non-flammable, water-based.
2. Service Temperature Range: Minus 20 to 180 deg F (Minus 29 to 82 deg C).

F. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.03 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, pre-sized a minimum of 8 ounces per sq. yd.

1. Tape Width: 4 inches
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch thick.
2. Aluminum: 0.0070 inch thick.

C. Wire: 14-gauge nickel copper alloy, 16-gauge, soft-annealed stainless steel, or 16-gauge, soft annealed galvanized steel.

D. Corner Angles: 28-gauge (0.3 mm), 1 inch by 1 inch (25 mm by 25 mm) aluminum, adhered to 2 inches by 2 inches (51 mm by 51 mm) kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.04 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm maximum.
2. Temperature Range: Minus 20 to 180 deg F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.

1. Water Vapor Permeance: 0.02 perm maximum.
2. Temperature Range: Minus 50 to 250 deg F.
3. Cooler: Aluminum.

PART 3 – EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean, dry and remove foreign materials such as rust, scale, and dirt.

3.02 INSTALLATION

A. Refer to schedules at the end of this section for materials, forms, jackets, and thicknesses required for each duct system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated ducts and plenums having surface operating temperatures below 60 deg.

D. Apply insulation material, accessories, and finishes according to the manufacturer’s printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply water based adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Install board insulation as follows:

1. Adhesive and Band Attachment: Secure board insulation tight and smooth with at least 50 percent coverage of water based adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.

2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

L. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches: Bonding water based adhesive applied in 6-inch (150-mm) wide transverse strips on 12-inch centers.

2. 24 inches and Larger: Anchor pins spaced 12 inches (300 mm) apart each way. Apply bonding adhesive to prevent sagging of the insulation.

3. Overlap joints 3 inches.

4. Seal joints, breaks, and punctures with vapor barrier compound.

3.03 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2 inches (40 mm) laps at longitudinal joints and 3 inches (75 mm) wide butt strips at end joints.

1. Seal openings, punctures, and breaks in vapor barrier jackets, and exposed insulation with vapor barrier compound.

3.04 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Duct Systems: Insulate all new interior ductwork.

3.05 DUCT SYSTEMS INSULATION SCHEDULE

A. All interior supply and return ducts:

Material	Type	Installed R-value	Vapor Barrier Req'd	Field-Applied Jacket
Glass Fiber	Blanket	6.0	Yes	None

B. All outdoor air intake ducts and outdoor air plenums:

Material	Type	Installed R-value	Vapor Barrier Req'd	Field-Applied Jacket
Glass Fiber	Blanket	8.0	Yes	None

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230714 – DUCT INSULATION - EXTERIOR

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and provisions of contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.02 SUMMARY

A. This section includes exterior supply and return ductwork and plenum insulation.

1.03 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.

B. Dual-Temperature Surfaces: Normal Operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 75 deg F.

D. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F.

E. Density: Is expressed in lb/cu. ft.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 specification sections.

B. Product and data for each type of duct insulation identifying k-value, thickness, and accessories.

C. Samples of each type of insulation. Identify each sample describing product and intended use. Submit 12 inches square sections of each sample materials.

D. Material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

E. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

1.05 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Exterior Insulation: Flame spread value of 25 or less and a smoke developed value of 50 or less.

1.06 SEQUENCING AND SCHEDULING

A. Schedule insulation application after cleaning and sealing of the new ductwork and testing of duct systems sealing; ductwork to be air and water tight to prevent tempered air exfiltration and water infiltration to SMACNA seal class 'A'.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering 'GREENGUARD'/'ENERGY-STAR' certified products that may be incorporated in the Work include, but are not limited to the following:

1. Rigid Foam Insulation:

    a. Owens Corning – Foamular 250.
    b. Dow – Styrofoam Highload 40.
    c. GreenGuard Type VI.

2. Protective Membrane:

    a. MFM Building Products Corp.–FlexClad 250 – 36"-52836 25mils
    b. Polyguard Products–Alumaguard / Alumaguard All Weather

2.02 RIGID FOAM – based on Owens Corning 'Foamular 250'

A. Material: Extruded closed cell polystyrene (XPS).

B. Board: ASTM C 578, Type IV, rigid board.

1. Thermal Conductivity: 0.20 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.

2. Thermal Resistance(R):5.0 per inch at75 deg F mean temperature.

C. Adhesive: Produced under the UL Classification.

1. Type: Non-flammable, water-based.

2. Application Temperature Range: 40ºF to 90ºF.

2.03 PROTECTIVE MEMBRANE – based on MFM – FlexClad 250 – 36"-52836 25mils

A. Material: Outer layer – embossed UV-resistant white weathering surface, multiple layers of high-density cross linked polyethylene and rubberized asphalt adhesive layer. Total thickness = 25 mils.

B. Flame Spread: 0 (ASTM E 84-97a)

C. Smoke Density: 5 (ASTM E 84-97a)

D. Vapor Permeance = 0.01 perms (E-96-95)

E. Adhesive = Modified Asphalt

2.04 ACCESSORIES AND ATTACHMENTS

A. Membrane Tape: (based on MFM 'Peel & Seal')

1. Tape Width: minimum 4 inches white finish
2. Vapor Permeance: <0.01 (ASTM E96)
3. Thickness: 25 mil minimum.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch thick.
2. Aluminum: 0.0070 inch thick.

C. Wire: 14-gauge nickel copper alloy, 16-gauge, soft-annealed stainless steel, or 16-gauge, soft annealed galvanized steel.

D. Edge/Corner/Close-off Angles: 28-gauge, 1 inch by 1 inch aluminum, adhered with membrane tape.

E. Anchor Pins **(for primary insulation attachment and for protective membrane covering on ductwork 24" wide and greater)**: Welded copper-coated steel pin for capacitor-discharge welding with a minimum 1 1/2" diameter galvanized speed washer capable of supporting/holding 100 pounds for direct pull perpendicular to the attached surface. Provide anchor pins and speed washers of sizes and diameters as may be otherwise recommended by the manufacturer for insulation type and thickness.

F. Spray Adhesives: based on MFM Spray Adhesive for protective membrane and Ductmate Protack/HV for insulation.

2.05 DUCT SEALING COMPOUNDS

A. Duct Sealant Compound: (based on 'Ductmate' Everseal) Water-based, non-flammable composition.

1. Water Resistant, No VOC's and UV Resistant.
2. Service Temperature Range: Minus 25 to 200 deg F.

B. Weatherproof Sealant: Flexible synthetic latex based, vapor/air barrier sealant designed to seal metal joints and seams.

PART 3 – EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean, dry and remove foreign materials such as rust, scale, and dirt including existing mastic coating on existing ductwork, existing fiberglass insulation, existing anchor pins, etc. Apply duct sealant compound to all joints and seams including all anchor pin holes, access plates, etc. (Reference SMACNA seal class 'A').

3.02 INSTALLATION

A. Refer to schedules at the end of this section for materials, forms, jackets, and thicknesses required for each duct system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state; follow manufacturer's installation guidelines.

C. Install vapor barriers on insulated ducts and plenums having surface operating temperatures below 60 deg.

D. Apply insulation material, accessories, protective membrane and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces. **NOTE: after top of duct insulation is installed, additional top of duct insulation is to be installed and pitched at a minimum of 1/4" per foot to prevent puddling on the top of the ductwork**.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier (i.e. exterior ductwork).

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Taper ends at 45 degree angle and seal with membrane tape and or spray adhesive.

I. Apply water based adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Install rigid foam board insulation as follows:

1. Adhesive and Band Attachment: Secure board insulation tight and smooth with at least 50 percent coverage of water based adhesive. Install bands, where required, spaced 12 inches apart. Protect insulation under bands and at exterior corners and edges with metal corner angles. Cover joints, seams, gaps and chipped edges with membrane tape.

2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 12 inches apart each way and 3 inches from insulation joints. Apply membrane tape to insulation in contact, open joints, breaks, punctures, and voids in insulation.

3. Apply protective membrane strickly adhering to the manufacturers installation instructions including 'pinning' on ductwork 24" wide and greater.

3.03 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Duct Systems: Unless otherwise indicated, insulate the following duct systems:

1. Exterior exposed supply and return ductwork.

3.04 DUCT SYSTEMS INSULATION SCHEDULE

A. EXTERIOR EXPOSED HVAC SUPPLY/RETURN DUCTS AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET/ MEMBRANE
RIGID FOAM	BOARD	2	YES (JOINTS AND SEAMS)	YES

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230800 – COMMISSIONING OF HVAC

PART 1 – GENERAL

1.01 DESCRIPTION

A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.

B. The systems to be commissioned are listed in Section 01810 Commissioning.

C. Commissioning requires the participation of Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Division 17. Division 23 shall be familiar with all parts of Division 17 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.02 RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23 are as follows (all references apply to commissioned equipment only):

1. Construction and Acceptance Phases

   a. Include and itemize the cost of commissioning in the contract price.

   b. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.

   c. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.

   d. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.

   e. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.

      1) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.

      2) The Commissioning Agent may request further documentation necessary for the commissioning process.

      3) This data request may be made prior to normal submittals.

   f. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.

g. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

h. Provide limited assistance to the CA in preparing the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

i. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the construction checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup. Refer to Section 01810 Commissioning for further details on start-up plan preparation.

j. During the startup and initial checkout process, execute the mechanical-related portions of the construction checklists for all commissioned equipment.

k. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.

l. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.

m. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

n. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment Section 01810. Assist the CA in interpreting the monitoring data, as necessary.

o. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, OR and A/E and retest the equipment.

p. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

q. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).

r. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

s. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Warranty Period

a. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

B. Mechanical Contractor. The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. Provide startup for all HVAC equipment, except for the building automation control system.

2. Assist and cooperate with the TAB contractor and CA by:

   a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.

   b. Including cost of sheaves and belts that may be required by TAB.

   c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

   d. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

3. Install a P/T plug at each water sensor, which is an input point to the control system.

4. List and clearly identify on the as-built drawings the locations of all airflow stations.

5. Prepare a preliminary schedule for Division 15 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

6. Notify the OR or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the OR or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

C. Temperature Controls Contractor. The commissioning responsibilities of the Temperature Controls Contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. Sequences of Operation Submittals. The Temperature Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

   a. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.

   b. All interactions and interlocks with other systems.

   c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.

   d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).

   e. Start-up sequences.

f. Warm-up mode sequences.

g. Normal operating mode sequences.

h. Unoccupied mode sequences.

i. Shutdown sequences.

j. Capacity control sequences and equipment staging.

k. Temperature and pressure control: setbacks, setups, resets, etc.

l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.

m. Effects of power or equipment failure with all standby component functions.

n. Sequences for all alarms and emergency shut downs.

o. Seasonal operational differences and recommendations.

p. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

q. Schedules, if known.

r. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

2. Control Drawings Submittal

a. The control drawings shall have a key to all abbreviations.

b. The control drawings shall contain graphic schematic depictions of the systems and each component.

c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

d. Provide a full points list with at least the following included for each point:

1) Controlled system
2) Point abbreviation
3) Point description
4) Display unit
5) Control point or setpoint (Yes / No)
6) Monitoring point (Yes / No)
7) Intermediate point (Yes / No)
8) Calculated point (Yes / No)

a) Key:
b) Point Description: DB temp, airflow, etc.

c) Control or Setpoint: Point that control equipment and can have its setpoint changed (OSA, SAT, etc.)
d) Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).
e) Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
f) Calculated Point: "Virtual" point generated from calculations of other point values.

The Temperature Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

4. Assist and cooperate with the TAB contractor in the following manner:

   a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).

   b. For a given area, have all required construction checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.

   c. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

5. Assist and cooperate with the CA in the following manner:

   a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system. Assist in the functional testing of all equipment. Provide two-way radios during the testing.

   b. Execute all control system trend logs.

6. The Temperature Controls Contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process in Section 01810 Commissioning. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:

   a. System name.

   b. List of devices.

   c. Step-by-step procedures for testing each controller after installation, including:

      1) Process of verifying proper hardware and wiring installation.

      2) Process of downloading programs to local controllers and verifying that they are addressed correctly.

      3) Process of performing operational checks of each controlled component.

4) Plan and process for calibrating valve and damper actuators and all sensors.

5) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has "passed" and is operating within the contract parameters.

e. A description of the instrumentation required for testing.

f. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.

7. Provide a signed and dated certification to the CA and OR upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

8. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified in Section 15950.

9. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

D. TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:

1. Six weeks prior to starting TAB, submit to the OR the qualifications of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician on which was lead. The Owner will approve the site technician's qualifications for this project.

2. Submit the outline of the TAB plan and approach for each system and component to the CA, OR and the Temperature Controls Contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.

3. The submitted plan will include:

a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.

b. An explanation of the intended use of the building control system. The Temperature Controls Contractor will comment on feasibility of the plan.

c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

e. Final test report forms to be used.

f. Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning,

total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.

g. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

h. Details of how total flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).

i. The identification and types of measurement instruments to be used and their most recent calibration date.

j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.

k. Confirmation that TAB understands the outside air ventilation criteria under all conditions.

l. Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).

m. Details of how building static and exhaust fan / relief damper capacity will be checked.

n. Proposed selection points for sound measurements and sound measurement methods.

o. Details of methods for making any specified coil or other system plant capacity measurements.

p. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.

q. Details regarding specified deferred or seasonal TAB work.

r. Details of any specified false loading of systems to complete TAB work.

s. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.

t. Details of any required interstitial cavity differential pressure measurements and calculations.

u. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

v. Plan for formal progress reports (scope and frequency).

w. Plan for formal deficiency reports (scope, frequency and distribution).

4. A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and OR at least twice a week.

5. Communicate in writing to the Temperature Controls Contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

6. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.

7. Provide the CA with any requested data, gathered, but not shown on the draft reports.

8. Provide a final TAB report for the CA with details, as in the draft.

9. Conduct functional performance tests and checks on the original TAB.

E. Mechanical Designer. Refer to Section 01810 Commissioning for the (reference only) responsibilities of the mechanical designer.

1.03 RELATED WORK

A. Refer to Section 01810 Commissioning, for a listing of all sections where commissioning requirements are found.

B. Refer to Section 01810 Commissioning for systems to be commissioned and Section 01810 Commissioning.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Division 23 shall provide all test equipment necessary to fulfill the testing requirements of this Division.

B. Refer to Section 01810 Commissioning for additional Division 23 requirements.

PART 3 - EXECUTION

3.01 SUBMITTALS

A. Division 23 shall provide submittal documentation relative to commissioning as required in this Section Part 1, Section 013300 and Section 01810 Commissioning.

3.02 STARTUP

A. The HVAC mechanical and Temperature Controls Contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 017423. Division 23 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and OR.

Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all construction checklists as soon as possible.

3.03 TAB

A. Refer to the TAB responsibilities in Part 1.02 above.

3.04 FUNCTIONAL PERFORMANCE TESTS

A. Refer to Section 01810 Commissioning for a list of systems to be commissioned and for a description of the process.

3.05 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. Refer to Section 01810 Commissioning for specific details on non-conformance issues relating to construction checklists and tests.

B. Refer to Section 01810 Commissioning for issues relating to functional performance tests.

3.06 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Division 23 shall compile and prepare documentation for all equipment and systems covered in Division 23 and deliver this documentation to the GC for inclusion in the O&M manuals, according to this section and Section 01730, prior to the training of owner personnel.

C. The CA shall receive a copy of the O&M manuals for review.

D. Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the Temperature Controls Contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.

1. Four copies of the controls training manuals in a separate manual from the O&M manuals.

2. Operation and Maintenance Manuals containing:

   a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.

   b. Full as-built set of control drawings (refer to Submittal section above for details).

   c. Full as-built sequence of operations for each piece of equipment.

   d. Full points list. In addition to the updated points list required in the original submittals (Part 1 of this section), a listing of all rooms shall be provided with the following information for each room:

      1) Floor
      2) Room number
      3) Room name
      4) Air handler unit ID

5) Reference drawing number
6) Air terminal unit tag ID
7) Heating and/or cooling valve tag ID
8) Minimum cfm
9) Maximum cfm

e. Full print out of all schedules and set points after testing and acceptance of the system.

f. Full as-built print out of software program.

g. Electronic copy on disk of the entire program for this facility.

h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

j. Control equipment component submittals, parts lists, etc.

k. Warranty requirements.

l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

3. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:

a. Sequences of operation
b. Control drawings
c. Points lists
d. Controller / module data
e. Thermostats and timers
f. Sensors and DP switches
g. Valves and valve actuators
h. Dampers and damper actuators
i. Program setups (software program printouts)

4. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.

E. Special TAB Documentation Requirements. The TAB will compile and submit the following with other documentation that may be specified elsewhere in the Specifications.

1. Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.

2. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.

F. Review and Approvals. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Section 01810 Commissioning, Part 3.8 for details.

3.07 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01810 Commissioning for additional details.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 01810 Commissioning for additional details.

C. Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:

1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01810 Commissioning.

2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.

3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer’s representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

6. The Temperature Controls Contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

8. Training shall include:

a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.

b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.

c. Discussion of relevant health and safety issues and concerns.

d. Discussion of warranties and guarantees.

e. Common troubleshooting problems and solutions.

f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.

g. Discussion of any peculiarities of equipment installation or operation.

h. The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1-1989R, 1996 is recommended.

i. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

9. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.

10. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

11. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

12. Duration of Training. The mechanical contractor shall provide training on each piece of equipment according to the following schedule.

Hours	System
8	Chillers and System
8	Boilers and System
3	Piping Systems
4	Chemical Treatment
12	Air Handler Units
1	Spot Unit Heaters
2	Air Terminal Units
1	Central Exhaust Systems
2	Supplementary Fans
2	Pumps
16	Controls System
16	Control system Follow-up
4	Humidifiers
4	Water Heaters
4	Fire Sprinkler Systems

D. Temperature Controls Contractor. The Temperature Controls Contractor shall have the following training responsibilities:

1. Provide the CA with a training plan four weeks before the planned training according to the outline described in Section 01810 Commissioning, Part 3.09.

2. The Temperature Controls Contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.

3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three

copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays. Manuals will be approved by the CA. Copies of audiovisuals shall be delivered to the Owner.

4. The trainings will be tailored to the needs and skill-level of the trainees.

5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.

6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

7. The Temperature Controls Contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

8. There shall be three training sessions:

    a. Training I. Control System. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

    b. Training II. Building Systems. The second session shall be held on-site and will consist of actual hands-on training after the completion of system commissioning. The session shall include instruction on:

        1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

        2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

        3) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.

        4) Every screen shall be completely discussed, allowing time for questions.

        5) Use of keypad or plug-in laptop computer at the zone level.

        6) Use of remote access to the system via phone lines or networks.

            a) Setting up and changing an air terminal unit controller.
            b) Graphics generation
            c) Point database entry and modifications

d) Understanding DDC field panel operating programming (when applicable)

c. Training III. The third training (Follow-up Training) will be conducted on-site six months after occupancy. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

E. TAB The TAB contractor shall have the following training responsibilities:

1. TAB shall meet for 2 hours with facility staff after completion of TAB and instruct them on the following:

a. Go over the final TAB report, explaining the layout and meanings of each data type.

b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.

c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

e. Other salient information that may be useful for facility operations, relative to TAB.

3.08 DEFERRED TESTING

A. Refer to Section 01810 Commissioning, Part 3.10 for requirements of deferred testing.

3.09 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described in Section 01810 Commissioning and the filled out start-up, initial checkout and construction checklists.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230923 – AUTOMATIC TEMPERATURE CONTROL SYSTEMS (Andover)

PART 1 - GENERAL

1.01 GENERAL

A. Furnish and install all temperature controls including all devices and accessories required for the installation / modification to an “Andover” (Schneider Electric Global) energy management and control system.

B. There is an existing Andover DDC front-end system, currently serviced by T.M. Bier & Associates. All new controls shall be Schneider Electric Global DDC, as a seamless extension of the existing BMS. The controls contractor will provide all network wiring between the existing BMS and the new controls, and will provide all graphics, front-end programming to map up the new controls. The contractor will include all licenses as necessary to accommodate the new controls.

C. All new controls shall be of the DDC type unless specified otherwise. All DDC controls shall be manufactured by Schneider Electric Global Inc. The design make for the web-based front-end controller and all local DDC controllers is Schneider Electric Global Inc.

D. The ATC contractor shall be authorized by the system manufacturer and shall submit training certificates and current proof that the contractor is a certified Schneider Electric Global Inc. installer / integrator.

E. Under no circumstances, will the Owner accept bids for DDC systems that are proprietary in nature. If the bidding contractor is including a DDC system other than Schneider Electric, it must meet all the requirements of this specification and the contractor must list the DDC system in a substitutions list and include the following information with his bid:

1. The name and address of the proposed ATC subcontractor and DDC system they are proposing.

2. A list of at least two additional sources for the installation, service and purchase of repair parts within a 50-mile radius of the School District. These sources must be completely independent from the proposed ATC subcontractor. The intent is to assure the District that they are not entering into a proprietary arrangement.

3. Written assurance that the proposed substitute DDC system meets all the requirements of this specification.

F. Control systems shall be complete in all respects, including all labor, materials, equipment and service necessary. The controls shall be of the DDC type unless otherwise specified.

G. Systems shall include, but not be limited to, all application specific controllers, transducers, transformers, cabinets, valves and operators, dampers and operators, relays, sensors, switches, wiring and terminals.

H. Systems shall be installed by competent mechanics regularly employed by a company whose primary business is the installation of automatic temperature control systems. The company must employ at least two control specialists who have successfully completed at least one Schneider Electric factory-authorized 5-day training program on the controls specified for this project. The ATC contractor will be required to submit proof of such training in the form of a Schneider Electric Global Certificate.

I. Installation shall include all control components, installation of all control wiring and pneumatic tubing. All wiring required for interlocking and interfacing controls with the equipment to be controlled, whether low voltage or line voltage; calibration and adjustment of all controls, dampers, linkages, etc. is part of this contract.

J. All control wiring concealed in walls or run in open areas of machine rooms shall be in conduit. In other locations, plenum rated cable shall be used.

K. The ATC Contractor shall provide PDF submittal showing how he proposes to complete the work specified herein. In this book, the ATC Contractor shall submit description of operation and schematic drawings, produced in AutoCAD, showing the wiring and pneumatic tubing of the entire control system to the District for review before starting any work. Bulletins describing each item of control equipment or component shall be included.

L. Upon completion of his work, the ATC Contractor shall provide PDF Operation & Maintenance Manuals showing exactly how each component of the system was installed, specifically noting any changes from the submittal book, and who authorized the change. Schematic drawings, sequences of operation and technical literature must be provided for all components of the system.

M. All automatic temperature control work completed under this Contract shall be covered under a one (1) year warranty and service contract effective on date of acceptance. Scheduled maintenance service shall be provided to attend to the normal maintenance required for proper system operation in the building.

N. It is the Contractor's responsibility to inspect the buildings, their existing systems and the project drawings to verify exact quantities of devices and controls required for the systems specified. No allowance will be made if the Contractor fails to make such an examination.

O. Provide nameplates on all devices, whether mounted on the face of the central and local control panels. In occupied areas, nameplates shall be concealed beneath covers of room type instruments, to describe functions.

P. All control panels shall include wire markers for each wire, with an identifying wiring diagram.

Q. The Control Contractor shall provide a minimum of two (2) one-hour training classes on the system operation and maintenance. This is to include both classroom and on-site training to ensure that the District’s custodial and maintenance personnel have adequate knowledge of the control system’s features as well as operation and maintenance requirements. The Contractor will provide printed documentation to all persons attending the training sessions.

1.02 CONTROLLERS

A. All room thermostats shall have covers with concealed adjustment. Thermostat or sensor locations not shown on the drawings shall be subject to approval of the Architect. All thermostats or sensors sensing temperature within ductwork or at coils are to be provided with elements of sufficient length to measure average temperature across the duct cross section or coil face. DDC space sensors shall have no local setpoint adjustment or override capability. It is the intent to make all adjustments from the front-end.

1.03 VALVES

A. All automatic control valves shall be fully proportioning unless otherwise specified, quiet in operation, and shall be arranged to fail-safe in either a normally open or normally closed position in the event of power failure. The open or closed position shall be as specified or as required to suit job conditions. Valves shall be capable of operating at varying rates of speed to correspond to the

exact dictates of the controller and variable load requirements. Provisions shall be made for valves operating in sequence with other valves or damper operators to have adjustable operating ranges and starting points to provide flexibility of adjustment, sequencing and throttling range.

B. Valves shall be sized by the ATC Contractor and guaranteed to meet the heating or cooling requirements as specified, and as indicated on the drawings. Unless otherwise specified, control valves shall have 125 psig cast iron bodies with flanged connections on valves 2 1/2" or larger. Unless otherwise specified, valve bodies shall have the same pressure characteristics as the piping in which they are installed.

C. No single valve, except zone valves, shall be larger than 2" in size. Where the capacity of equipment to be controlled requires a valve larger than 2", two (2) valves shall be installed in parallel with the smaller valve sized for a maximum of 1/3 of the total capacity.

D. All control valves, unless otherwise noted, shall be of the globe valve type.

E. Actuators shall be electronic. They shall be mechanically fail-safe. Capacitor-based fail-safe actuators are not acceptable.

1.04 AUTOMATIC DAMPERS

A. Automatic dampers shall be supplied and sized by the ATC Contractor or the equipment manufacturer to properly control the flow of air using methods similar to control valve sizing. The Sheet Metal Subcontractor shall provide required safing to fit the damper into the duct work. The dampers shall be constructed with galvanized blades and frames. Blades shall not exceed 6" in width and shall be provided with special replaceable rubber seals on the blade edges and sides. Blades shall be formed from two spot-welded sheets for extra strength. Frames shall be channel shaped for strength, and to enclose linkage thus keeping linkage out of air stream.

B. The entire construction shall be such that leakage does not exceed 4 cfm per square foot with 1" of static pressure across the damper, as tested in accordance with the AMCA 500D standard.

C. Dampers shall have opposed, or parallel blades as required by the application. The proper linkage shall be furnished to provide equal percentage or linear characteristics as required by the application.

1.05 CONTROL PANELS

A. All control panels for this project will meet the following requirements as a minimum:

1. The control panel shall be a fully enclosed cabinet, of baked enamel, steel or aluminum material construction and shall meet the requirements of NEMA 1 enclosures.

2. The panel will have a hinged door with a locking latch.

3. Each component on the front panel shall have an appropriate engraved nameplate fabricated from .062” or .125” thick phenolic material, with engraved permanent lettering. Stick-on labels are not acceptable.

1.06 DDC SYSTEM WIRING

A. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the Controls Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. The contractor shall provide, install and wire all repeaters, terminators as recommended by the BMS manufacturer.

B. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.

C. All control wiring materials and installation methods shall comply with DDC system manufacturer's recommendations.

D. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the Controls Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the Controls Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

1.07 QUALITY ASSURANCE

A. There is an extensive installation of Schneider Electric DDC controls in the District and in this building. The District must have assurance that the ATC sub-contractor has full-time employees that are certified in the specified product line and has the resources within the ATC sub-contractor's company to meet the requirements of this project, as well as interface with the existing Andover DDC systems without voiding any current project warranties as a result of this project.

B. The ATC sub-contractor shall be an independent contractor whose primary business is the engineering, programming, installation/wiring and service of total integrated building management systems.

SECTION 2 – SEQUENCES OF OPERATION

2.01 SCHNEIDER ELECTRIC DDC FRONT-END

A. Furnish and install all temperature controls including all devices and accessories required for the installation of a complete Schneider Electric web-based energy management and control system. The contractor shall network and map up all new DDC controls to the existing Andover Controls BMS system. The contractor will expand the existing system as necessary, including all hardware, software, licenses, and additional Controllers/Servers as necessary to provide the sequences and points lists specified.

B. This contractor will furnish and install as many master controllers as required to accommodate all new equipment, and maintain a free Java heap of at least 10MB, with 25% spare capacity for future expansion. If the controller cannot accommodate the new controls while still maintaining 10% expansion capability and at least 10MB free heap, an additional controller and dedicated Server with Server PC shall be provided at no additional cost to the owner. The contractor will be required to demonstrate this front-end capacity during training and in the O&M documentation.

C. The existing front-end is networked to a districtwide energy monitoring Server. The Controls Contract will ensure that all new controls added to this project, including any master controllers, will be compatible with the existing Server and all new trends added to this project will be mapped up to the existing Server to match existing trend recording cycles.

D. The Controls Contractor will provide schedules for all equipment, zoned by different areas of the building as designated by the Owner. Providing a separate dedicated schedule for each piece of equipment is not acceptable unless specifically directed by the Owner.

E. This contractor will modify the BMS floor plan of the entire building, with links to all DDC controlled equipment. Upon completion of this project, all DDC controlled equipment will be one seamless DDC front-end with graphical interface for each piece of equipment. Simply putting hyperlinks or data tables to represent the new controls is not acceptable. Graphics shall match existing graphics in all respects.

F. The controls subcontractor will provide all network wiring and will provide all graphics, front-end programming to map up the new controls. The contractor will include all additional licenses as necessary to accommodate the new controls.

G. Override and offline Indication: All overridden points/setpoints will be displayed on the graphic in the same color background as the existing graphics, with text to match the existing graphics. All points operating under normal control logic will be in colors to match existing. All points that are offline will be indicated similar to existing.

H. Alarm Indication: Alarms shall be programmed to display on a customized graphical alarm screen indicating when any unit's supply fan command does not match the supply fan status. Low discharge temperature alarms shall also be indicated on the alarm screen if the discharge temperature of any unit drops below 45°F. An Alarm notification image will indicate on the home page and on every graphical page indicating an unacknowledged alarm condition. The flashing alarm notification will disappear once the user has acknowledged the alarm, but the alarm will remain in the alarm history database.

I. All DDC points indicated in the points list to be trended will be recorded at 1-hour intervals (or change of value).

J. Optimal Start: An adaptive optimal start algorithm shall be used to enable the new equipment with the outside air damper closed and heating valve open to warm-up the space prior to occupancy time, necessary to achieve zone occupied temperature setpoints by the start of scheduled occupied period. The learning adaptive algorithm shall compare the zone temperature to its setpoint at beginning of scheduled occupied period and shall automatically adapt the heating response time for the next unoccupied period. The maximum warm-up start time will be adjustable at the DDC front-end. At no later than the scheduled occupancy time, the units will transition to occupied mode sequence as indicated below, with the outside air damper modulating open to minimum position to provide minimum required volumetric flow of outside air (adjustable). When the unit comes on during optimal start and/or warm-up mode, the central plant will be indexed to day mode settings to ensure the pumps, control valves are in day mode to allow optimal start/warm-up sequence to occur.

2.02 SOFTWARE

A. All controllers shall be programmed using licensed original software. Supervisory controllers shall be programmed using manufacturer's software, and controllers shall be programmed with manufacturer's software. All software shall be at current versions compatible with the hardware, including all patches and updates.

2.03 ROOFTOP UNITS / AIR HANDLING UNITS / UNIT VENTILATORS, DEHUMIDIFICATION

A. The units shall be controlled by Schneider Electric room mounted sensors to maintain occupied and unoccupied space temperature set points and relative humidity. The sensor will have no adjustment – all setpoint adjustments will be made at the DDC front-end. A discharge air sensor (8' averaging capillary), mixed air temperature sensor and controller are to be installed for each unit. A Schneider Electric Advanced application controller shall be provided for control of these units.

B. The DDC front-end will index the unit between occupied and unoccupied cycles. Whenever the unit's supply fan is off, the outside air damper shall be fully closed.

C. The units shall be tied into the building's DDC control system for occupied/unoccupied cycle operation. All setpoints will be adjustable from the front-end.

D. Optimal Start: An adaptive optimal start algorithm shall be used to enable the unit with the outside air damper closed and heating enabled to warm-up the space prior to occupancy time, necessary to achieve zone occupied temperature setpoints by the start of scheduled occupied period. The learning adaptive algorithm shall compare the zone temperature to its setpoint at beginning of scheduled occupied period and shall automatically adapt the heating response time for the next unoccupied period. The maximum warm-up start time will be adjustable at the DDC front-end. At no later than the scheduled occupancy time, the unit will transition to occupied mode sequence as indicated below, with the outside air damper modulating open to minimum position to provide minimum required volumetric flow of outside air (adjustable).

E. Freezestat: A freezestat shall be provided, draped across the full face of the coils in order to detect a freezing condition. Upon an initial trip at T1 = 40 deg. F., the heating valve will open fully & the outdoor air damper will close. An alarm will be sent to the BMS front end. This action will automatically reset once the internal unit temperature has risen. Upon a hard trip at T2 = 38 deg. F., the unit fans will be shut down, the heating valve will open fully and the outdoor air damper will close. This will be a manual reset condition. An alarm will be sent to the BMS front end.

F. Damper Control: The unit economizer dampers will be controlled to maintain minimum ventilation rates and to maximize free cooling. Once the supply fan has been proven running, the outdoor air damper will move to it's minimum position. The outdoor air damper will be allowed to modulate open beyond that required if free cooling is available, and required to maintain indoor temperature setpoint.

G. Occupied Period: During the occupied period, the supply fan will run continuously and indicate to the DDC controller via a current relay wired to a binary input of the controller that the fan is running. Once the fan is proven running, the outside air damper shall start at minimum position, maintaining code ventilation requirements. Whenever the space temperature is below the space set point of 68°F (adjustable), the heating valve(s) will be cycled to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high limit of 100°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating setpoint. As the space temperature rises above the space set point (adjustable), the outside air damper shall modulate open beyond their minimum position, up to 100% to maintain the cooling space setpoint. The controller's program will maintain a minimum discharge and mixed air temperature of 60°F (adjustable) by enabling the heating and modulating the outside air damper, beyond the minimum position, in sequence without overlap).

H. Occupied Period – Cooling Mode: The front-end will determine the heating and cooling modes of the unit based on the outdoor air temperature/free cooling availability. If the space is on a call for cooling and there is no free cooling available and the supply fan is proven running, the outdoor air damper will move to its minimum open position (as described above, adjustable from the front-end) and the DDC controller will cycle the stages of DX cooling to maintain the space cooling set point. If the economizer dampers fail to satisfy the cooling demand and the space temperature is above setpoint, the economizer dampers will modulate to minimum code required ventilation position and the stages of mechanical cooling will be enabled to maintain cooling temperature setpoint.

I. Occupied Period – Dehumidification (Rooftop Units Only): When the fan is proven running and the space relative humidity is above the space humidity setpoint (adjustable), the DDC controller will enable the dehumidification and the hot gas reheat command at the Rooftop Unit. Damper control will be as described under the "damper control" section.

J. During the unoccupied cycle, the unit will be programmed off, and the outside air dampers shall be closed.

K. All outside air dampers shall fail in the closed position.

L. Pressure Control, Occupied Mode: Heating, ventilating & air conditioning equipment shall be interlocked with new (& existing where applicable) kitchen hood fans as required to maintain adequate makeup air for the Kitchen hoods. Provide position sensor on outdoor air dampers as required to send a speed control signal to the exhaust fan speed controller (ECM motor controller or variable frequency drive).

2.04 SPLIT AC UNIT (VRF SYSTEMS)

A. The VRF systems will operate under standalone factory controls.

B. The ATC contractor will install and wire the factory furnished wall thermostat and will provide the low voltage interlock control wiring to the condensing unit.

C. Provide an interlock between the new VRF cooling equipment & the existing heating & ventilating equipment (where applicable) such that there can be no simultaneous heating & cooling operation and that during winter heating, only economizer cooling can be used in the event that the space exceeds it's heating setpoint. Heating and cooling setpoints shall maintain a 5 deg. F. minimum offset.

D. Provide graphics to show each space, with all setpoints, H&V unit status, VRF indoor unit status, outdoor VRF unit status, & status of interlocks.

2.05 EXHAUST FANS

A. The ATC contractor shall supply and install all required DDC controllers, controls and required hardware to allow the following sequences of operation to occur.

B. The exhaust fan will run continuously during the occupied mode and be off during the unoccupied mode based on schedule resident in the BMS front-end. Fan status will be monitored at the BMS.

SECTION 3 – DYNAMIC COLOR GRAPHICS REQUIREMENTS

The color graphics that the user will see to operate the system shall be resident in the web-based front-end controller. PC-based systems are not acceptable. The main graphic shall be a three-dimensional floor plan of the building with links to each room and its HVAC system. The display will provide links to all DDC equipment in the building. Links to data trends and schedules shall be located on each system's graphic screen. The minimum point information that is to be mapped to the front-end panel and shown in the color graphic screens is as follows:

Auditorium Rooftop Unit / H&V Units / Air Handling Units / Unit Ventilators				
Description	Point	History	Alarm	Totalize
Discharge Air Temperature	AI	X	X	
Mixed Air Temperature	AI	X	X	
Pre-Occupancy Purge Command	AV	X		
Pre-Occupancy Purge Max Runtime Allowed	AV	X		
Post-Flush Command	AV	X		
Post-Flush Max Runtime Allowed	AV	X		
Space Temperature	AI	X	X	
Space Relative Humidity	AI	X	X	
Outside Air Temperature	AV	X		
Occupied Space Temperature Heating Set Point	AV	X		
Occupied Space Temperature Cooling Set Point	AV	X		

Occupied Space Relative Humidity Set Point	AV	X		
Unoccupied Space Temperature Heating Set Point	AV	X		
Unoccupied Space Temperature Cooling Set Point	AV	X		
Active Temperature Setpoint	AV	X		
Active Relative Humidity Setpoint	AV	X		
Mixed Air Low Limit Set Point	AV	X		
Discharge Air Low Limit Set Point	AV	X		
Heating Command	AO	X		
Cooling Command	BO	X		
Outside Air Damper Command	AO	X		
Exhaust Air Damper Command	AO	X		
Return Air Damper Command	AO	X		
Dehumidification/Hot Gas Reheat Command	AO	X		
Supply Fan Status	BI	X	X	X
Supply Fan Command	BO	X	X	
Exhaust Fan Status	BI	X	X	X
Exhaust Fan Command	BO	X	X	
Occupied Command	BV			
Occupied Status	BV	X		
Status of DDC controller	BV		X	

Exhaust Fans				
Description	Point	History	Alarm	Totalize
Fan Command	BO	X	X	
Fan Status	BI	X		
Occupied Command	BV			
Occupied Status	BV	X		
Status of DDC controller	BV		X	

VRF Equipment: Show all space setpoints, H&V unit status, valve positions, damper positions, VRF interlock status, VRF indoor unit status, VRF unit mode.

SECTION 4 – HISTORICAL DATA TRENDING REQUIREMENTS

A. All the points listed will be trended in the FX front-end to record historical data for a period of 7 days, trended once per hour, and archived at the FX Server daily. The District intends to track these data for improving efficiency and occupancy conditions.

SECTION 5 – HARDWARE REQUIREMENTS

A. General Description:

1. The Building Automation System (BAS) shall use an open architecture and where applicable support a multi-vendor environment. To accomplish this effectively, the BAS shall not be limited to a single open communication protocol standard, but to also integrate third-party devices and

applications via additional protocol and through the latest software standards. The system configuration shall be available for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

2. The Building Automation System shall consist of the following:

    a. DDC Controllers (HVAC, etc.)
    b. Input, Output Modules
    c. Local Display Devices
    d. Portable Operator's Terminals – Portable PC’s
    e. Distributed User Interfaces
    f. Network processing, data storage and communications equipment
    g. Other components required for a complete and working BAS.

3. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

4. The system architectural design shall eliminate dependence upon any single device for alarm generation and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

5. Acceptable Systems

    a. Continuum by Schneider Electric Global
    b. Others per addendum

B. BAS Architecture – Automation Network

1. The automation network shall be configured as a Client/Server network with a web server operating on the Client’s LAN/WAN. The web browser interface is extended over the LAN/WAN. Monitoring and control of the BAS is available using the web browser interface.

2. The automation network shall include the option of a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.

3. The BAS shall network multiple user interface clients, system controllers and systems supervisors as required for systems operation.

4. The automation network option shall be capable of operating at a communication speed of 100 Mbps.

5. The automation network option will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

C. BAS Architecture – Control Network

1. Network Automation Controllers, (NAC) shall provide management over the control network(s) and shall support the following communications protocols:

    a. BACnet® Standard (ANSI/ASHRAE Standard 135-) MS/TP master.
    b. LONWORKS® enabled devices using the free topology transceiver (FTT-1x).
    c. Modbus RTU and Modbus TCP.

2. The NAC shall be BTL (BACnet Testing Laboratories) listed as B-BC (BACnet Building Controller) and support the following data link options:

    a. BACnet Internet Protocol (IP) (Annex J).
    b. BACnet IP (Annex J) Foreign.
    c. ISO 8802-3, Ethernet (Clause 7).

3. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.

4. Digital Controllers shall reside on the control network.

5. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

6. The PICS shall be submitted 10 days prior to bidding.

D. User Interface – Browser Based Interface

1. The system shall be capable of supporting an unlimited number of clients using standard Web browser such as Internet Explorer™ or Mozilla Firefox™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the Building Automation System (BAS), shall not be acceptable.

3. The Web browser client shall support at a minimum, the following functions:

    a. User log-on identification and password shall be required. If an unauthorized user attempts access, notice of access failure shall be displayed. Security using authentication and encryption techniques to prevent unauthorized access shall be implemented.
    b. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
    c. Storage of the graphical screens shall be in the Network Automation Controller (NAC) or the server, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
    d. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
    e. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
    f. Modify common application objects, such as schedules and setpoints in a graphical manner.
    g. Commands binary objects to start and stop.
    h. View logs and charts.
    i. View alarms.

4. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

E. User Interface – Alarms

1. Alarm feature shall allow user configuration of criteria to create, route, and manage alarms and events. It shall be possible for specific alarms from specific points to be routed to specific alarm recipients. The alarm management portion of the user interface shall, at the minimum, provide the following functions:

    a. Allow configuration to generate alarms on any numeric, binary, or data point in the system.
    b. Generate alarm records that contain a minimum of a timestamp, original state, acknowledged state, alarm class and priority.
    c. Allow the establishment of alarm classes that provide the routing of alarms with similar characteristics to common recipients.
    d. Allow a user, with the appropriate security level, to manage alarms - including sorting, acknowledging, and tagging alarms.

F. User Interface – Reports and Summaries

1. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:

    a. All points in the BAS
    b. All points in each BAS application
    c. All points in a specific controller
    d. All points in a user-defined group of points
    e. All points currently in alarm
    f. All BAS schedules
    g. All user defined and adjustable variables, schedules, interlocks and the like.

2. Reports shall be exportable to .pdf, .txt, or .csv formats.

3. The system shall allow for the creation of custom reports and queries.

G. User Interface – Schedules

1. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:

    a. Regular schedules
    b. Repeating schedules
    c. Exception Schedules

2. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.

3. It shall be possible to define one or more exception schedules for each schedule including references to calendars.

4. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days. Holidays and special days shall be user-selected with the pointing device or keyboard.

H. User Interface – Passwords

1. Multiple-level password access protection shall be provided to allow the system manager to assign user interface control, display, and database manipulation capabilities deemed appropriate for each user based on an assigned password.

2. Each user shall have the following: a username, a password, and access levels.

3. The system shall provide the capability to require a password of minimum length and require a combination of characters and numerical or special characters.

4. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.

5. The system shall provide unlimited flexibility with access rights. A minimum of four levels of access shall be provided along with the ability to customize the system to provide additional levels.

6. A minimum of 100 unique passwords shall be supported.

7. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

8. The system shall automatically generate a report of log-on/log-off and system activity for each user.

9. All log data shall be available in .pdf, .txt, and .csv formats.

I. User Interface – Dynamic Color Graphics

1. The graphics application program shall be supplied as an integral part of the User Interface.

2. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.

3. The graphics shall be able to display real-time data that is acquired, derived, or entered.

4. Graphics runtime functions –Each graphic application shall be capable of the following functions:

5. All graphics shall be fully scalable.

6. The graphics shall support a maintained aspect ratio.

7. Multiple fonts shall be supported.

8. Unique background shall be assignable on a per graphic basis.

9. Operation from graphics – It shall be possible to change values (setpoints) and states in systems-controlled equipment within the Web browser interface.

10. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all runtime binding.

J. Historical Data Collection

1. All numeric, binary or data points in the system database shall allow their values to be logged over time (trend log). Each historical record shall include the point's name, a time stamp including time zone, and the point's value.

2. The configuration of the historical data collection shall allow for recording data based on change of value or on a user-defined time interval.

3. The configuration of the historical data collection shall allow for the collection process to stop or rollover when capacity has been reached.

4. A historical data viewing utility shall be provided with access to all history records. This utility shall allow historical data to be viewed in a table or chart format.

5. The history data table view shall allow the user to hide/show columns and to filter data based on time and date. The history data table shall allow exporting to .txt, .csv, or .pdf file formats.

6. The historical data chart view shall allow different point histories to be displayed simultaneously and provide panning and zooming capabilities.

K. Audit Log

1. For each log entry, provide the following data:

   a. Time and date
   b. User ID
   c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

L. Network Automation Controller (NAC)

The NAC must provide the following hardware features as a minimum:

1. Communications

   a. Two 10/100 Mb Ethernet Port – RJ-45 connections
   b. One RS-485 port (up to 57,600 baud)
   c. Expandable communications ports including LON, RS485, Modem, Wireless Terminal Equipment Control
   d. All required protocol drivers as required by the sequence of operation.

2. Battery Backup

   a. Battery backup provided for all on board functions including I/O
   b. Battery is monitored and trickle charged
   c. Battery maintains processor operation through power failures for a pre-determined interval, and then writes all data to flash memory, shuts the processor down, and maintains the clock for three months.

3. Environment

   a. Must be capable of operation over a temperature range of 0 ºC to 50 ºC (32 ºF to 122 ºF).
   b. Must be capable of withstanding storage temperatures of between 0 ºC and 60 ºC (32 ºF to 140 ºF).
   c. Must be capable of operation over a humidity range of 5% to 95% RH, non-condensing.

4. The Network Automation Controller (NAC) shall be a fully user-programmable device capable of providing all the capability described in Section 2.3 Part A.

5. Automation network – The Network Automation Controller (NAC) shall reside on the automation network. Each NAC shall support one or more sub-networks of controllers.

6. The Network Automation Controller shall have the capability to communicate directly with Modbus without the use of an additional gateway.

7. The Network Automation Controller shall have the capability to provide secure communications via SSL (Secure Socket Layer).

8. User Interface – Each Network Automation Controller (NAC) shall have the ability to deliver a web-based user interface as previously described. All computers connected physically or virtually to the automation network shall have access to the web-based UI.

9. Power Failure – In the event of the loss of normal power, The Network Automation Controller (NAC) shall continue to operate for a defined period after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software. Flash memory shall be incorporated for all critical controller configuration data.

10. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.

11. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

12. Certification – All controllers shall be listed by Underwriters Laboratories (UL).

M. Input Device Characteristics

1. General Requirements: Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

2. Temperature Sensors: Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations. The temperature sensor shall be of the resistance type and shall be either two-wire 1000-ohm nickel RTD, or two-wire 1000-ohm platinum RTD.

3. Room Temperature Sensors: Room sensors shall be constructed for either surface or wall box mounting.

4. Thermo wells: When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure. Thermo wells and sensors shall be mounted in a threadolet or ½-inch NFT saddle and allow easy access to the sensor for repair or replacement. Thermo wells shall be constructed of 316 stainless steel.

5. Outside Air Sensors: Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

6. Control Relays: Control pilot relays shall be of a modular plug-in design with retaining springs or clips. Mounting bases shall be snap-mount. DPDT, 3PDT, or 4PDT relays shall be provided as appropriate for application. Contacts shall be rated for 10 amps at 120 VAC. Relays shall have an integral indicator light and check button. Acceptable manufacturers: Idec, Functional Devices

7. Electronic/Pneumatic Transducers: Electronic to Pneumatic transducers shall provide: Output: 3-15 psig,

8. Input: 4-20 mA or 0-10 VDC, manual output adjustment, pressure gauge external replaceable supply air filter. Acceptable manufacturers: Schneider Electric, Mamac

N. APPLICATION SPECIFIC CONTROLLERS

1. General Purpose Programmable Controllers (PCG)

   a. The General-Purpose Programmable Controller shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
   b. Controller shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
   c. A BACnet Protocol Implementation Conformance Statement shall be provided for the controller.
   d. The Conformance Statement shall be submitted 10 days prior to bidding.
   e. The controller shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
   f. The controller shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
   g. The controller shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
   h. The controller shall include a removable base to allow pre-wiring without the controller.
   i. The controller shall include troubleshooting LED indicators to identify the following conditions:
      1) Power On
      2) Power Off
      3) Download or Startup in progress, not ready for normal operation
      4) No Faults
      5) Device Fault
      6) Field Controller Bus - Normal Data Transmission
      7) Field Controller Bus - No Data Transmission
      8) Field Controller Bus - No Communication
      9) Sensor-Actuator Bus - Normal Data Transmission
      10) Sensor-Actuator Bus - No Data Transmission
      11) Sensor-Actuator Bus - No Communication
   j. The controller shall accommodate the direct wiring of analog and binary I/O field points.
   k. The controller shall support the following types of inputs and outputs:
   l. Universal Inputs - shall be configured to monitor any of the following:
      1) Analog Input, Voltage Mode
      2) Analog Input, Current Mode
      3) Analog Input, Resistive Mode
      4) Binary Input, Dry Contact Maintained Mode
   m. Binary Inputs - shall be configured to monitor either of the following:
      1) Dry Contact Maintained Mode
      2) Pulse Counter Mode
   n. Analog Outputs - shall be configured to output either of the following:
      1) Analog Output, Voltage Mode
   o. Analog Output, current Mode
   p. Binary Outputs - shall output the following:
      1) 24 VAC Triac

q. Configurable Outputs - shall be capable of the following:
    1) Analog Output, Voltage Mode
    2) Binary Output Mode
r. The controller shall have the ability to reside on a Field Controller Bus (FC Bus).
    1) The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
    2) The FC Bus shall support communications between the controllers and the Supervisory Controller.
    3) The FC Bus shall also support Expansion I/O (PCX) communications with the field controllers and with the Supervisory Controller.
s. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the field controllers and the furthest connected device.
t. The field controllers shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
    1) The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
    2) The SA Bus shall support up to 10 devices per trunk.
    3) The SA Bus shall operate at a maximum distance of 1,200 Ft. between the PCG and the furthest connected device.
u. The field controllers shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.

2. The field controllers shall support, but not be limited to, the following:

    a. Chilled water/central plant automation applications including but not limited to:
        1) the selection and sequencing of up to 8 chillers of different sizes
        2) the selection and sequencing of up to 8 (each) primary and secondary chilled water pumps of varying pump capacities
        3) the selection and sequencing of up to 8 condenser water pumps
        4) the selection and sequencing of cooling towers and bypass valve, including single speed, multi-speed, and Vernier control.
        5) a proven and documented central cooling plant optimization program that incorporates custom equipment efficiency profiles, without rewriting software code, in order to meet the building load using the least amount of energy as calculated.
        6) the use of advanced control algorithms that apply equipment specific parameters, including operational limits and efficiency profiles, in order to determine equipment, start and runtime preferences.
        7) the identification of the most efficient equipment combination and automatic control of state and speed of all necessary equipment to balance runtime, optimize timing and sequencing and ensure the efficiency and stability of the central cooling plant.
        8) the control definition for the chiller plant in a single controller, as supported by available memory and point Input/Output (I/O), or capable of being split across multiple controllers.
            a) Heating central plant applications
            b) Built-up air handling units for special applications
    b. Terminal and packaged units
    c. Special programs as required for systems control.

3. Programmable Controller Expansion I/O Modules

    a. The Programmable Controller Expansion I/O Module provides additional inputs and outputs for use in the field controllers.
    b. The I/O module shall communicate with the field controllers over the FC Bus or the SA Bus.

c. The I/O module shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
d. A BACnet Protocol Implementation Conformance Statement shall be provided for the field controllers.
e. The Conformance Statement shall be submitted 10 days prior to bidding.
f. The I/O module shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
g. The I/O module shall have a minimum of 4 points to a maximum of 17 points.
h. The I/O module shall support the following types of inputs and outputs:
    1) Universal Inputs - shall be configured to monitor any of the following:
        a) Analog Input, Voltage Mode
        b) Analog Input, Current Mode
    2) Analog Input, Resistive Mode
    3) Binary Input, Dry Contact Maintained Mode
    4) Binary Inputs - shall be configured to monitor either of the following:
        a) Dry Contact Maintained Mode
        b) Pulse Counter Mode
    5) Analog Outputs - shall be configured to output either of the following:
        a) Analog Output, Voltage Mode
        b) Analog Output, current Mode
    6) Binary Outputs - shall output the following:
        a) 24 VAC Triac
    7) Configurable Outputs - shall be capable of the following:
        a) Analog Output, Voltage Mode
        b) Binary Output Mode

4. The I/O module shall include troubleshooting LED indicators to identify the following conditions:

    a. Power On
    b. Power Off
    c. Download or Startup in progress, not ready for normal operation.
    d. No Faults
    e. Device Fault
    f. Normal Data Transmission
    g. No Data Transmission
    h. No Communication

END OF SECTION

DIVISION 23 - MECHANICAL

SECTION 23 09 93 – SEQUENCE OF OPERATIONSGENERAL

A. Unit Ventilators (Occupancy based DCV)

a. The units shall be controlled by Schneider Electric room mounted sensors to maintain occupied and unoccupied space temperature set points. The sensor will have no adjustment – all setpoint adjustments will be made at the DDC front-end. A discharge air sensor (8' averaging capillary), mixed air temperature sensor and controller are to be installed for each unit. A Schneider Electric Advanced application controller shall be provided for control of these units.

b. The DDC front-end will index the unit between occupied and unoccupied cycles. Whenever the unit's supply fan is off, the outside air damper shall be fully closed.

c. The units shall be tied into the building's DDC control system for occupied/unoccupied cycle operation. All setpoints will be adjustable from the front-end.

d. Optimal Start: An adaptive optimal start algorithm shall be used to enable the unit with the outside air damper closed and heating enabled to warm-up the space prior to occupancy time, necessary to achieve zone occupied temperature setpoints by the start of scheduled occupied period. The learning adaptive algorithm shall compare the zone temperature to its setpoint at beginning of scheduled occupied period and shall automatically adapt the heating response time for the next unoccupied period. The maximum warm-up start time will be adjustable at the DDC front-end. At no later than the scheduled occupancy time, the unit will transition to occupied mode sequence as indicated below, with the outside air damper modulating open to 20% of minimum code required ventilation position to provide minimum required DCV volumetric flow of outside air (adjustable).

e. Pre-Occupancy Purge: Thirty minutes prior to the scheduled occupancy time of the unit, the unit will be indexed to a pre-occupancy cycle. This cycle shall run the unit supply / exhaust fans for 30 minutes with the outdoor air / return air / spill air dampers positioned as required to allow for the code required ventilation rate at maximum occupancy. Once the fan is proven running, the outdoor air damper will modulate open, the heating valve will be under the control of the low limit discharge sensor, maintaining discharge air at 60 deg. (adjustable).

f. Post Occupancy Purge: When the unit is indexed into the unoccupied mode as dictated by the occupancy schedule programmed into the BMS, the unit will run in a post occupancy flush cycle. The outdoor air, return air & exhaust / spill air dampers shall be positioned to provide 100% quantity of outdoor air required for full occupancy of the space, with all fans running until the space CO2 levels reach outdoor air ambient conditions. When indoor air CO2 levels are equal to outdoor air CO2 levels, the unit will shut down, entering the unoccupied cycle.

g. Freezestat: A freezestat shall be provided, draped across the full face of the coils in order to detect a freezing condition. Upon an initial trip at T1 = 40 deg. F., the heating valve will open fully & the outdoor air damper will close. An alarm will be sent to the BMS front end. This action will automatically reset once the internal unit temperature has risen. Upon a hard trip at T2 = 38 deg. F., the unit fans will be shut down, the heating valve will open fully

and the outdoor air damper will close. This will be a manual reset condition. An alarm will be sent to the BMS front end.

h. Damper Control: The unit economizer dampers will be controlled to maintain CO2 levels based upon a room occupancy sensor for demand controlled ventilation. Once the supply fan has been proven running, the outdoor air damper will move to 20% of the minimum code required ventilation rate. When the space occupancy sensor detects room occupancy, the unit ventilator outdoor air damper will open to at least the minimum code required ventilation position. The outdoor air damper will be allowed to modulate open beyond that required for demand controlled ventilation if free cooling is available, and required to maintain indoor temperature setpoint.

i. Occupied Period: During the occupied period, the supply fan will run continuously and indicate to the DDC controller via a current relay wired to a binary input of the controller that the fan is running. Once the fan is proven running, the outside air damper shall modulate to 20% of minimum code required ventilation rate. Whenever occupancy is sensed, outdoor air damper will modulate to the full minimum code required ventilation rate / damper position. Whenever the space temperature is below the space set point of 68°F (adjustable), the heating valve(s) will be cycled to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high limit of 100°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating setpoint. As the space temperature rises above the space set point (adjustable), the outside air damper shall modulate open beyond their minimum position, up to 100% to maintain the cooling space setpoint. The controller's program will maintain a minimum discharge and mixed air temperature of 60°F (adjustable) by enabling the heating and modulating the outside air damper, beyond the minimum position, in sequence without overlap).

j. Occupied Period – Cooling Mode: The front-end will determine the heating and cooling modes of the unit based on the outdoor air temperature/free cooling availability. If the space is on a call for cooling and there is no free cooling available and the supply fan is proven running, the outdoor air damper will move to 20% of the minimum open position (no occupancy) or the minimum outdoor air position (occupancy, adjustable from the front-end) and the DDC controller will cycle the stages of DX cooling / cycle the chilled water valve to maintain the space cooling set point. If the economizer dampers fail to satisfy the cooling demand and the space temperature is above setpoint, the economizer dampers will modulate to minimum position as previously described and the stages of mechanical cooling / cycling of chilled water valve will be enabled to maintain cooling temperature setpoint.

l. During the unoccupied cycle, the unit's supply fan shall be cycled to maintain space setback temperature set point of 55 deg. F. (adjustable). The heating valve will be modulated to maintain the night heating setpoint. The outside air dampers shall be closed.

m. All outside air dampers shall fail in the closed position.

A. <u>New Face & Bypass Unit Ventilators, Hot Water / DX Cooling</u>

a. The units shall be controlled by Andover room mounted sensors to maintain occupied and unoccupied space temperature set points. A discharge air sensor (8' averaging capillary), space temperature sensor and unitary controller are to be installed for each unit.

b. The units will be provided with a factory installed freeze-stat. This is to be left in place to shut the fan off when a freezing condition occurs. Whenever the fan is off, the outside air damper will be closed. As an added feature, the DDC controller will use the discharge air sensor to detect a potential freezing condition. The set point will be 5°

higher than the set point of the factory freeze-stat. If such a condition occurs, the outside air damper will close, the fan will shut off and an alarm will be displayed on the front-end and an email will be sent from the DDC front-end system to those recipients designated by the District. The alarm and email messages will indicate which unit caused the alarm and be stamped with the date and time that the alarm occurred.

c. The units shall be tied into the building's Andover DDC control system for occupied/unoccupied cycle operation. All setpoints will be adjustable from the front-end.

d. Occupied Period: During the occupied period, the supply fan will run continuously and indicate to the DDC controller via a current relay wired to a binary input of the controller that the fan is running. Once the fan is proven running, the outside air damper shall modulate open to minimum position (adjustable), to provide the minimum required volumetric flow rate of outside air. Whenever the space temperature is below the space set point of 68°F (adjustable), the face & bypass damper will be fully open to the heating coil to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high limit of 120°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating setpoint. As the space temperature rises above the space set point (adjustable), the face & bypass damper will fully face the bypass and the outside air damper shall modulate open beyond their minimum position to maintain the cooling space setpoint. The controller's program will maintain a minimum discharge temperature of 60°F (adjustable) by modulating the F&B damper and modulating the outside air damper, beyond the minimum position required volumetric flow rate of outside air, in sequence without overlap.

e. Occupied Period – Cooling Mode (For units with CHW cooling): The FX front-end will determine the heating and cooling modes of the unit based on the outdoor air temperature/free cooling availability. When indexed into mechanical cooling mode, the supply fan will run and indicate to the DDC controller via a current relay wired to a binary input of the controller that the fan is running. The outdoor air damper will be at its minimum position (adjustable from the front-end). The DDC controller will modulate the face/bypass damper to maintain the space cooling set point.

f. During the unoccupied cycle the unit's supply fan shall be cycled to maintain space setback temperature set point. The face/bypass damper will fully face the coil. The outside air damper shall be closed. There will be no cooling operation during the unoccupied mode.

g. The outside air damper shall fail in the closed position.

h. For any new units that have existing, or new auxiliary finned tube radiation as shown on the plans, a dedicated control signal from the DDC controller will cycle a new auxiliary radiation control valve (provided by ATC contractor and installed by Mechanical Contractor) to maintain the space setpoint. A lower setpoint will be maintained during the unoccupied cycle. For hot water applications, the ftr control valve will be 2-position. For steam applications, the ftr control valve will be modulating control, temperature rated for steam.

Dynamic Color Graphics Requirements

a. The color graphics that the user will see to operate the system shall be resident in the front-end. The main graphic shall be a three-dimensional floor plan of the building with links to each room and its HVAC system. The display will provide links to all DDC equipment in the building. Links to data trends and schedules shall be located on each system's graphic screen.

b. The minimum point information that is to be mapped to the front-end panel and shown in the color graphic screens is as follows:

Unit Ventilators				
Description	**Point**	**History**	**Alarm**	**Totalize**
Damper Command	AO	X		
Discharge Air Temperature	AI	X	X	
Discharge Low Limit Set Point	AV	X		
F&B damper	AO	X		
Minimum Outdoor Air Damper Position (adjustable)	AV	X		
Occupied Command	BV			
Occupied Space Set Point	AV	X		
Occupied Status	BV	X		
Outside Air Temperature	AI	X		
Space Temperature	AI	X	X	
Status of DDC controller	BV		X	
Supply Fan Command	BO	X	X	
Supply Fan Status	BI	X	X	X
Unoccupied Space Set Point	AV	X		
Working Setpoint	AV	X		

G. <u>Split AC Units (VRF Systems)</u>

a. The VRF systems will operate under standalone factory controls.

b. The ATC contractor will install and wire the factory furnished wall thermostat and will provide the low voltage interlock control wiring to the condensing unit.

c. Provide an interlock between the new VRF cooling equipment & the existing heating & ventilating equipment (where applicable) such that there can be no simultaneous heating & cooling operation and that during winter heating, only economizer cooling can be used in the event that the space exceeds it's heating setpoint. Heating and cooling setpoints shall maintain a 5 deg. F. minimum offset.

d. Provide interface to the Schneider BMS and provide graphics to show each space, with all setpoints, H&V unit status, VRF indoor unit status, outdoor VRF unit status, & status of interlocks.

e. Additionally, the Split AC units will be provided with factory provided BACnet communication cards and/or gateway controllers. Programming and startup of the Split AC unit BACnet cards/gateway controllers will be provided by the Split AC Unit manufacturer. The ATC contractor will provide the communication wiring between these units and the front-end. All DDC points on these BACnet cards will be seamlessly mapped to the DDC front-end, with setpoints adjustable from the BMS front-end. The ATC contractor will include all BACnet licenses, hardware, programming, software necessary for the expanded front-end to accomplish this.

f. An individual graphic shall be provided for each unit. For multiple Splits units serving a common space, a common graphic will be provided controlling the equipment

in the room with common sequenced heating and cooling setpoints. Additional graphics will be provided for each individual unit.

g. The VRF condensing unit will be networked to the BMS front-end via a factory BACnet MSTP card. The ATC contractor will include the wiring, addressing and integration of the VRF BACnet points to the BMS front-end.

Dynamic Color Graphics Requirements

c. The color graphics that the user will see to operate the system shall be resident in the Andover front-end. The main graphic shall be a three-dimensional floor plan of the building with links to each room and its HVAC system. The display will provide links to all DDC equipment in the building. Links to data trends and schedules shall be located on each system's graphic screen.

d. The minimum point information that is to be mapped to the front-end panel and shown in the color graphic screens is as follows:

Split AC Units				
Description	**Point**	**History**	**Alarm**	**Totalize**
Integrated DDC Points		X	X	X
Occupied Command	BV	X		
Status of DDC controller	BV		X	

VRF Condensing Unit				
Description	**Point**	**History**	**Alarm**	**Totalize**
Integrated points of factory VRF controller (BACnet)	AV/BV	X	X	
Status of DDC controller	BV		X	

H. Pound Ridge Elementary School – Existing Large Air Handling Units

Temperature controls for the existing air handling units for the Main Office Suite area and the Kindergarten Wing area shall be modified to meet the following sequence of operation:

1. Heating Mode – Unoccupied: During the unoccupied mode, the unit shall remain off, with the outdoor air damper fully closed. A low limit thermostat installed in the unit will allow flow through the heating coil if temperatures below 40 deg. F. (adjustable) are sensed within the unit.
2. Heating Mode, Occupied: During the occupied mode, the unit shall start, the unit shall open the outdoor air damper to it's minimum code required ventilation position, maintaining code required ventilation rates and the unit shall modulate the heating coil control valve as required to maintain neutral air discharge (+/-62 deg. F., adjustable). The unit main / return fans VFD will run. The unit will run in this fashion for the entirety of the occupied cycle. The unit shall be equipped with a freezestat covering the entire face of the coil. If a freezing condition occurs, the unit shall close the outdoor air damper, shut the fan down and send an alarm to the BMS. Note that the classroom thermostat shall modulate the existing fin tube radiator control valve within the room as required to perform the remainder of the heating for each room.

3. Cooling Mode, Unoccupied: During the unoccupied mode, mechanical cooling shall be locked out and the unit shall remain off, with the outdoor air damper fully closed.

4. Cooling Mode, Occupied: During the cooling occupied mode, the outdoor air dampers shall modulate to the open position required for code required ventilation. Outdoor air / economizer will act as stage 1 cooling. Should temperature / humidity conditions of the outdoor air be insufficient to meet discharge air setpoint, mechanical cooling will be enabled. Mechanical cooling will be cycled as required to maintain a 78 deg. F. / 60% RH discharge air setpoint, adjustable. Provide discharge air temperature sensors. Provide a discharge air humidity sensor so that the unit may operate in a "dehumidification (reheat via existing heating coil) mode if desired by the owner. Note that the classroom (or Office) VRF cassette will be modulated by it's related thermostat as required to perform the remainder of the cooling requirement.

   All fans shall be proven running when commanded to do so and shall show status at the head end graphic.

   Damper & valve actuators shall be mapped up to show their actual position at the head end.

   All coils shall show inlet water temperature and discharge water temperature at the head end graphic.

   All units shall read discharge air temperature, return air temperature and mixed air temperature at the graphic.

   All unit alarms (temperature / freezestat / fan fault / etc.) shall be transmitted to the head end graphic for that unit and shall also be transmitted to the main alarm page at the BMS.

I. Exhaust Fans

a. The ATC contractor shall supply and install all required DDC controllers, controls and required hardware to allow the following sequences of operation to occur.

b. The exhaust fan will run continuously during the occupied mode and be off during the unoccupied mode based on schedule resident in the BMS front-end. Fan status will be monitored at the BMS.

Dynamic Color Graphics Requirements

The color graphics that the user will see to operate the system shall be resident in the Andover web-based front-end controller. PC-based systems are not acceptable. The main graphic shall be a three-dimensional floor plan of the building with links to each room and its HVAC system. The display will provide links to all DDC equipment in the building. Links to data trends and schedules shall be located on each system's graphic screen. The minimum point information that is to be mapped to the front-end panel and shown in the color graphic screens is as follows:

Rooftop Unit / H&V Units / Air Handling Units / Unit Ventilators				
Description	**Point**	**History**	**Alarm**	**Totalize**
Discharge Air Temperature	AI	X	X	

Mixed Air Temperature	AI	X	X	
Unit discharge RH	AI	X	X	
Unit discharge RH setpoint	AV	X		
Pre-Occupancy Purge Command	AV	X		
Pre-Occupancy Purge Max Runtime Allowed	AV	X		
Post-Flush Command	AV	X		
Post-Flush Max Runtime Allowed	AV	X		
Space Temperature	AI	X	X	
Space Relative Humidity	AI	X	X	
Outside Air Temperature	AV	X		
Occupied Space Temperature Heating Set Point	AV	X		
Occupied Space Temperature Cooling Set Point	AV	X		
Occupied Space Relative Humidity Set Point	AV	X		
Unoccupied Space Temperature Heating Set Point	AV	X		
Unoccupied Space Temperature Cooling Set Point	AV	X		
Active Temperature Setpoint	AV	X		
Active Relative Humidity Setpoint	AV	X		
Mixed Air Low Limit Set Point	AV	X		
Discharge Air Low Limit Set Point	AV	X		
Heating Command	AO	X		
Cooling Command	BO	X		
Outside Air Damper Command	AO	X		
Exhaust Air Damper Command	AO	X		
Return Air Damper Command	AO	X		
Dehumidification/Hot Gas Reheat Command	AO	X		
Supply Fan Status	BI	X	X	X
Supply Fan Command	BO	X	X	
Exhaust Fan Status	BI	X	X	X
Exhaust Fan Command	BO	X	X	
Occupied Command	BV			
Occupied Status	BV	X		
Status of DDC controller	BV		X	

Exhaust Fans				
Description	**Point**	**History**	**Alarm**	**Totalize**
Fan Command	BO	X	X	
Fan Status	BI	X		
Occupied Command	BV			
Occupied Status	BV	X		
Status of DDC controller	BV		X	

ROOFTOP ENERGY RECOVERY UNITS WITH DX COOLING, HOT GAS RE-HEAT & GLYCOL HOT WATER DUCT HEATING COILS:

Energy Recovery Rooftop Units with DX Cooling, Hot Gas Reheat Equipment Tags (11 Units Total).
RTU-LIBRARY
RTU-LARGE CAFE
RTU-SMALL CAFÉ A
RTU-SMALL CAFÉ B
RTU-SMALL CAFÉ C
RTU-SMALL CAFÉ D
RTU-SMALL GYM A
RTU-SMALL GYM B
RTU-CLASSROOM A-LGI SUITE
RTU-CLASSROOM B-LGI SUITE
RTU-LGI

Energy Recovery Rooftop Units Glycol Hot Water Duct Coil Tags (11 Duct Coils Total)
HWC-RTU-LIBRARY
HWC-RTU-LARGE CAFE
HWC-RTU-SMALL CAFÉ A
HWC-RTU-SMALL CAFÉ B
HWC-RTU-SMALL CAFÉ C
HWC-RTU-SMALL CAFÉ D
HWC-RTU-SMALL GYM A
HWC-RTU-SMALL GYM B
HWC-RTU-CLASSROOM A-LGI SUITE
HWC-RTU-CLASSROOM B-LGI SUITE
HWC-RTU-LGI

Rooftop Unit with DX Cooling, Hot Gas Reheat, Energy Recovery, and Glycol Hot Water Duct Coil (11 TOTAL UNITS) (RTU-TAGS LISTED IN TABLE) (HOT WATER COIL TAGS LISTED IN TABLE ABOVE)

1. General

a. The Contractor shall provide, install, wire the following for each RTU: Johnson F4-CGM controller, NSB8BHN wall temperature and RH sensor, TE-6315P-1 (8' averaging discharge air sensor), TE-6315P-1 (8' averaging mixed air sensor), current relay wired to monitor the supply fan, fail-safe, normally closed outside air damper actuator, fail-safe, normally open, modulating heating control valve.
b. The ATC contractor will provide and install a freeze-stat, wired to shut of the supply and exhaust fan in all positions of the H-O-A switch. Manual reset of the freezestat is required. As an added feature, the DDC controller will use the discharge air sensor to detect a potential freezing condition. The set point will be 5° higher than the set point of the freeze-stat. If such a condition occurs, the outside air damper shall close, the fans will shut down, the heating valve shall open, and an alarm generated at the DDC front-end.
c. Whenever the unit's supply fan is off, the outside air damper shall be fully closed.
d. Occupied/unoccupied cycle determination will be made via the BMS front-end.
e. All setpoints will be adjustable from the BMS front-end.

2. Occupied Hours (Cooling Mode)
    a. During occupied hours, RTU shall be enabled:
        i. The supply fan shall run continuously.
        ii. Once the fan is proven running, the Outside air damper shall open to minimum outside air position and the Return air damper shall open to a percentage based on (100% open – Minimum Outside Air Damper Position %)
        iii. DX Cooling stage(s) shall be enabled. Unit shall modulate discharge air temperature to maintain room temperature setpoint (74 F adjust.)
    b. In the event that RTU has a command to enable either the supply air fan, modulating steam control valve, return & outside air damper positions, DX cooling stage(s) and is still disabled, an alarm will be displayed on the BMS.
3. Occupied Hours (Dehumidification Mode)

a. During occupied hours, when the supply fan is proven running, the BMS controller will enable the dehumidification/hot gas reheat command at the RTU to maintain the space relative humidity set point.

4. Unoccupied Hours (Cooling Mode)
    a. During unoccupied hours, RTU shall be disabled with outside air damper position at 0% open.
5. Occupied Hours (Heating Mode)
    a. During occupied hours, RTU shall be enabled:
        i. The supply fan shall run continuously.
        ii. Once the fan is proven running, the Outside air damper shall open to minimum outside air position and the Return air damper shall open to a percentage based on (100% open – Minimum Outside Air Damper Position %)
    b. New Hot Water Duct Coil (HWC-RTU)
        i. New DDC modulating control valve shall modulate the supply air discharge temperature based on a new DDC room thermostat (72 F adjust). Whenever the space temperature is below the space set point of (adjustable), the heating valve will be open to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high limit of 100°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating setpoint. As the space temperature rises above the space set point (adjustable), the outside air damper shall modulate open beyond their minimum position, up to 100% to maintain the cooling space setpoint. The controller's program will maintain a minimum discharge temperature of 60°F (adjustable) by enabling the heating and modulating the outside air damper, beyond the minimum position required volumetric flow rate of outside air, in sequence without overlap.
    c. In the event that RTU has a command to enable either the supply air fan, modulating control valve, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat

trips on hot water duct coil, an alarm will be displayed on the BMS.

6. Unoccupied Hours (Heating Mode)
    a. During unoccupied hours, RTU shall be off and hw heating valve shall be open. Upon a call for heat at the unoccupied heating set point:
        i. Supply fan blower shall be enabled.
        ii. Outside air damper shall be at 0% open (Recirculation Mode).
        iii. Return air damper shall be 100% open
        iv. DDC modulating control valve shall modulate open to maintain the heating set point.
    b. In the event that RTU has a command to enable either the supply air fan, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat trips on hot water duct coil, an alarm will be displayed on the BMS.
        i. DDC modulating control valve shall modulate open to maintain the heating set point.
    c. In the event that RTU has a command to enable either the supply air fan, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat trips on hot water duct coil, an alarm will be displayed on the BMS.
7. Occupied Hours (Energy Wheel)
    a. During occupied hours, the energy wheel will be enabled to run whenever the RTU is on a call for heating or mechanical cooling.
    b. The energy wheel will be disabled whenever the unit is on a call for economizer cooling.
    c. The energy wheel will be disabled during the unoccupied mode.
    d. Energy wheel frost controls will be factory provided.
    e. Energy wheel VFD speed set point will be set at the BMS front-end, and ERV alarm status will be monitored at the BMS front-end.

GLYCOL HOT WATER CABINET HEATERS SEQUENCE OF OPERATIONS:

Glycol Hot Water Coil Hydronic Cabinet Heaters Equipment Tags.

CH-RM 156
CH-RM 141
CH-GUIDANCE COR A
CH-RM 139
CH-RM 137
CH-GUIDANCE COR B
CH-RM 125
CH-RM 117
CH-RM 115
CH-RM 114
CH-RM 111
CH-RM 109
CH-RM 103
CH-RM 104
CH-RM 105
CH-RM 164 -SECURITY OFFICE
CH-RM 159 -VESTIBULE
CH-RM 123 -VESTIBULE
CH-ART SUITE CORRIDOR (TWO)
CH-RM 227
CH-VISIT LOCKERS CORR A
CH-VISIT LOCKERS CORR B
CH-RM 239
CH-RM 241
CH-RM 223
CH-LOCKERS CORR A
CH-LOCKERS CORR B
CH-RM 222
CH-RM 203
CH-RM 210
CH-LIBRARY EXIT (NEXT TO QUIET STUDY 120)
CH-RM 203

Glycol Hot Water Hydronic Cabinet Heaters with No Fresh Air (CH-TAGS LISTED IN TABLE)

A. Glycol Hot Water Cabinet Heater (CH-Tags) Unit (Heating)
   1. General
      a. The Contractor shall provide, install, wire the following: Johnson F4-CGM controller, TE-6314P-1 wall temperature sensor, TE-6315P-1 (8' averaging discharge air sensor), current relay wired to monitor the supply fan,

fail-safe, normally closed outside air damper actuator, fail-safe, normally open, modulating heating control valve.

b. Occupied/unoccupied cycle determination will be made via the BMS front-end.
c. All setpoints will be adjustable from the BMS front-end.
d. Dedicated Outdoor Air System (DOAS) serving this space shall be running to provide tempered fresh air to space. Refer to DOAS sequence of operations in this specification for further details.

2. Occupied Hours
    a. During occupied hours, the CH-Tags shall be enabled:
        i. The supply fan shall run continuously.
        ii. CH-Tags Supply fan shall be enabled.
        iii. New DDC modulating glycol hot water control valve shall modulate the supply air discharge temperature based on a new DDC room thermostat (72 F adjust). Whenever the space temperature is below the space set point of (adjustable), the heating valve will be open to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high limit of 100°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating setpoint. As the space temperature rises above the space set point (adjustable), the glycol hot water control valve shall modulate & slowly close until the space temperature setpoint is met.
    b. In the event that CH-Tags has a command to enable either the supply air fan, modulating hot water control valve, return air damper positions and is still disabled, an alarm will be displayed on the BMS.
    c. Heating shall be enabled when outside air temperature is 65 deg F (adj) and space cooling unit shall be locked out.
3. Unoccupied Hours
    a. During unoccupied hours, the CH-Tags shall be enabled:
        i. Supply fan shall be enabled.

ii. Return air damper shall be 100% open.
iii. New DDC modulating glycol hot water control valve shall modulate the supply air discharge temperature based on a new DDC room thermostat (60 F adjust)

b. In the event that CH-Tags has a command to enable either the supply air fan, modulating glycol hot water control valve & return damper positions and is still disabled, an alarm will be displayed on the BMS.

GLYCOL HOT WATER CABINET UNIT HEATERS SEQUENCE OF OPERATIONS:

Glycol Hot Water Coil Cabinet Unit Heaters Equipment Tags.
CUH-RM 225
CUH-RM 233
CUH-RM 234
CUH-RM 235
CUH-RM 236
CUH-RM 237
CUH-RM 218
CUH-RM 219
CUH-RM 208
CUH-RM 212

A. Glycol Hot Water Cabinet Unit Heater (CUH-Tags) Unit (Heating)
1. General
a. The Contractor shall provide, install, wire the following: Johnson F4-CGM controller, TE-6314P-1 wall temperature sensor, TE-6315P-1 (8' averaging discharge air sensor), current relay wired to monitor the supply fan, fail-safe, normally closed outside air damper actuator, fail-safe, normally open, modulating heating control valve.
b. Occupied/unoccupied cycle determination will be made via the BMS front-end.
c. All setpoints will be adjustable from the BMS front-end.

d. Heating-Ventilation (H-V) unit serving this space shall be running to provide tempered fresh air to space. Refer to H-V Unit sequence of operations in this specification for further details.

2. Occupied Hours
    a. During occupied hours, the CUH-Tags shall be enabled:
        i. The supply fan shall run continuously.
        ii. CUH-Tags Supply fan shall be enabled.
        iii. New DDC modulating glycol hot water control valve shall modulate the supply air discharge temperature based on a new DDC room thermostat (72 F adjust). Whenever the space temperature is below the space set point of (adjustable), the heating valve will be open to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high limit of 100°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating setpoint. As the space temperature rises above the space set point (adjustable), the glycol hot water control valve shall modulate & slowly close until the space temperature setpoint is met.
    b. In the event that CUH-Tags has a command to enable either the supply air fan, modulating hot water control valve and is still disabled, an alarm will be displayed on the BMS.
    c. Heating shall be enabled when outside air temperature is 65 deg F (adj) and space cooling unit (if applicable) shall be locked out.
3. Unoccupied Hours
    a. During unoccupied hours during heating season, the CUH-Tags shall be enabled:
        i. Supply fan shall be enabled.
        ii. New DDC modulating glycol hot water control valve shall modulate the supply air discharge temperature based on a new DDC room thermostat (60 F adjust)
    b. In the event that CUH-Tags has a command to enable either the supply air fan, modulating glycol hot water

control valve and is still disabled, an alarm will be displayed on the BMS.

DEDICATED OUT AIR SYSTEMS (DOAS) SEQUENCE OF OPERATIONS:

Dedicated Outdoor Air Systems (DOAS) Equipment Tags.
DOAS-1
DOAS-2

Dedicated Outdoor Air Systems (DOAS) Equipment Glycol Hot Water Duct Coil Tags.
HWC-DOAS-1
HWC-DOAS-2

Notes:

A. DOAS-1 has a glycol hot water duct coil (HWC-DOAS-1)
B. DOAS-2 has a glycol hot water duct coil (HWC-DOAS-2)

1. General

f. The Contractor shall provide, install, wire the following for each DOAS unit: Johnson F4-CGM controller, return air temperature and RH sensor, TE-6315P-1 (8' averaging discharge air sensor), TE-6315P-1 (8' averaging mixed air sensor), current relay wired to monitor the supply fan, fail-safe, normally closed outside air damper actuator, fail-safe, normally open, modulating heating control valve.

g. The ATC contractor will provide and install a freeze-stat, wired to shut of the supply and exhaust fan in all positions of the H-O-A switch. Manual reset of the freezestat is required. As an added feature, the DDC controller will use the discharge air sensor to detect a potential freezing condition. The set point will be 5° higher than the set point of the freeze-stat. If such a condition occurs, the outside air damper shall close,

the fans will shut down, the heating valve shall open, and an alarm generated at the DDC front-end.

h. Whenever the unit's supply fan is off, the outside air damper shall be fully closed.
i. Occupied/unoccupied cycle determination will be made via the BMS front-end.
j. All setpoints will be adjustable from the BMS front-end.

2. Occupied Hours (Cooling Mode)
    k. During occupied hours, DOAS unit shall be enabled:
        i. The supply and exhaust fans shall run continuously.
        ii. Once the supply fan is proven running, the Outside air damper shall open to minimum outside air position and the Return air damper shall open to a percentage based on (100% open – Minimum Outside Air Damper Position %)
        iii. DX Cooling stage(s) shall be enabled. Unit shall modulate supply air discharge dry bulb & wet bulb air temperature to maintain 55 deg F (dry bulb-adj.) and 54 deg F (wet bulb-adj.) to send into supply air ductwork.
        iv. Energy Wheel motor VFD shall be displayed (Start, Stop, % Speed, Alarm/Fault)
        v. Energy Wheel display showing frost control mode
    l. In the event that DOAS has a command to enable either the supply air fan, exhaust/relief air fan, modulating 3-way DDC hot water control valve, return & outside air damper positions, DX cooling stage(s), energy wheel motor & wheel motor VFD and is still disabled, an alarm will be displayed on the BMS.
3. Unoccupied Hours (Cooling Mode)
    m. During unoccupied hours, DOAS-TAG shall be disabled with outside air damper position & relief air damper position at 0% open.
4. Occupied Hours (Heating Mode)
    n. During occupied hours, RTU shall be enabled:
        i. Outside air damper shall open to 100% fully open position.
        ii. Relief/Exhaust air damper shall open to 100% fully open position.

iii. Upon proof of dampers opening, Supply fan & Exhaust/Relief Fan shall both be enabled.
iv. Energy Wheel motor VFD shall be displayed (Start, Stop, % Speed, Alarm/Fault)
v. Energy Wheel display showing frost control mode

o. New Hot Water Duct Coil (DOAS)
i. New DDC modulating control valve shall modulate to maintain the supply air discharge temperature set point (78 F adjustable).

p. In the event that RTU has a command to enable either the supply air fan, modulating control valve, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat trips on hot water duct coil, an alarm will be displayed on the BMS.

5. Unoccupied Hours (Heating Mode)

q. During unoccupied hours, DOAS-TAG shall be off and hw heating valve shall be open. Upon a call for heat at the unoccupied heating set point:
i. Supply fan blower shall be enabled.
ii. Outside air damper shall be at 0% open (Recirculation Mode).
iii. Return air damper shall be 100% open
iv. DDC modulating control valve shall modulate open to maintain the heating set point.

r. In the event that RTU has a command to enable either the supply air fan, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat trips on hot water duct coil, an alarm will be displayed on the BMS.
i. DDC modulating control valve shall modulate open to maintain the heating set point.

s. In the event that DOAS-TAG has a command to enable either the supply air fan, modulating hot water control valve, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat trips on hot water duct coil, an alarm will be displayed on the BMS.

6. Occupied Hours (Energy Wheel)

t. During occupied hours, the energy wheel will be enabled to run whenever the DOAS is on a call for heating or mechanical cooling.

u. The energy wheel will be disabled whenever the unit is on a call for economizer cooling.
v. The energy wheel will be disabled during the unoccupied mode.
w. Energy wheel frost controls will be factory provided.
x. Energy wheel VFD speed set point will be set at the BMS front-end, and ERV alarm status will be monitored at the BMS front-end.

1. Unoccupied Hours (Heating Mode)
    a. During unoccupied hours, DOAS-TAG shall be disabled:
        i. Outside air damper shall be at 0% open.
        ii. Exhaust/Relief air damper shall be at 0% open.
        iii. Supply & Exhaust fans shall be disabled.
        iv. DDC modulating hot water control valve shall be at 100% open.
        v. Energy Wheel motor & motor VFD shall be disabled.

GLYCOL HOT WATER PERIMETER FIN TUBES SEQUENCE OF OPERATIONS:

Glycol Hot Water Fin Tubes Equipment Tags.
FT-RM 168A
FT-RM 168B
FT-RM 167
FT-RM 165
FT-RM 163
FT-RM 136
FT-RM 135
FT-RM 134
FT-RM 133
FT-RM 132
FT-RM 131
FT-RM 130
FT-RM 129
FT-RM 128
FT-RM 127

FT-RM LIBRARY COVE (NEXT TO VESTIBULE 123)
FT-RM 213A
FT-RM 213B
FT-RM214
FT-RM 207
FT-RM 205A
FT-RM 205B
FT-RM 202A
FT-RM 202B
FT-RM 209A
FT-RM 209B
FT-RM 230A
FT-RM 230B
FT-RM228A
FT-RM228B
FT-RM226A
FT-RM226B

A. Glycol Hot Water Perimeter Fin Tube (FT-Tags) Unit (Heating)
   1. General
      a. The Contractor shall provide, install, wire the following: Johnson F4-CGM controller, TE-6314P-1 wall temperature sensor, TE-6315P-1 (8' averaging discharge air sensor), current relay wired to monitor the supply fan, fail-safe, normally closed outside air damper actuator, fail-safe, normally open, modulating heating control valve.
      b. Occupied/unoccupied cycle determination will be made via the BMS front-end.
      c. All setpoints will be adjustable from the BMS front-end.
      d. Heating-Ventilation (H-V) or Dedicated Outdoor Air System (DOAS) unit serving this space shall be running to provide tempered fresh air to space. Refer to H-V Unit or DOAS Unit sequence of operations in this specification for further details.
   2. Occupied Hours
      a. During occupied hours, the FT-Tags shall be enabled:
         i. New DDC modulating glycol hot water control valve shall modulate the water flow for the perimeter finned tube based on a new DDC room

thermostat (72 F adjust). Whenever the space temperature is below the space set point of (adjustable), the heating valve will be open to maintain the room temperature heating set-point. As the space temperature rises above the space set point (adjustable), the glycol hot water control valve shall modulate & slowly close until the space temperature setpoint is met.

b. In the event that FT-Tags modulating hot water control valve has a command to open and is still disabled, an alarm will be displayed on the BMS.

c. Heating shall be enabled when outside air temperature is 65 deg F (adj) and space cooling unit (if applicable) shall be locked out.

3. Unoccupied Hours

a. During unoccupied hours during heating season, the FT-Tags shall be enabled:

i. New DDC modulating glycol hot water control valve shall modulate the supply air discharge temperature based on a new DDC room thermostat (60 F adjust)

b. In the event that FT-Tags has a command to enable modulating glycol hot water control valve and is still disabled, an alarm will be displayed on the BMS.

Electrical Cabinet Heaters Equipment Tags.
ECH-STUDENT COMMONS A
ECH-STUDENT COMMONS B
ECH-WORK ROOM
ECH-TOILET 229
ECH-TOILET 231
ECH-RM 242
ECH-RM 240
ECH-RM 204
ECH-BOY'S LOCKER TOILET
ECH-GIRL'S LOCKER TOILET
ECH-RM 211

A. New Electrical Cabinet Heaters (ECH-TAG)
   1. General
      a. The Contractor shall provide, install, and wire the following: Johnson F4-CGM controller, TE-6314P-1 wall temperature sensor.
      b. Occupied/unoccupied cycle determination will be made via the BMS front-end.
      c. All setpoints will be adjustable from the BMS front-end.
   2. Occupied Hours
      a. During occupied hours, the electrical cabinet heater shall be enabled & shall modulate to maintain space temperature based on a DDC room temperature thermostat (72F adjust)
      b. In the event that the electrical cabinet heater has a command to enable and is still disabled, an alarm will be displayed on the BMS.
   3. Unoccupied Hours
      a. During unoccupied hours, the duct heater shall be put into a night setback mode & electrical cabinet heater shall be enabled & shall modulate to maintain space temperature based on a DDC room temperature thermostat (60 F adjust).
      b. In the event that the electrical cabinet heater has a command to enable and is still disabled, an alarm will be displayed on the BMS.
   4. During cooling season, the units shall be disabled & electrical heating stage(s) shall be disabled during occupied & unoccupied hours.

100% OUTSIDE AIR HEATING-VENTILATION (H-V) UNITS GLYCOL HOT WATER DUCT HEATING COILS:

Heating-Ventilation (H-V) Units with Glycol Hot Water Heating
HV-LOCKER SUITE
HV-VISITING LOCKERS

100% OUTSIDE AIR HEATING-VENTILATION (H-V) UNITS WITH GLYCOL HOT WATER COILS) (HV-TAGS LISTED IN TABLE)

A. General

a. The Contractor shall provide, install, wire the following for each H-V unit: Johnson F4-CGM controller, NSB8BHN duct-mounted temperature and RH sensor, TE-6315P-1 (8' averaging discharge air sensor), TE-6315P-1 (8' averaging mixed air sensor), current relay wired to monitor the supply fan, fail-safe, normally closed outside air damper actuator, fail-safe, normally open, modulating heating control valve.

b. The ATC contractor will provide and install a freeze-stat, wired to shut of the supply and exhaust fan in all positions of the H-O-A switch. Manual reset of the freezestat is required. As an added feature, the DDC controller will use the discharge air sensor to detect a potential freezing condition. The set point will be 5° higher than the set point of the freeze-stat. If such a condition occurs, the outside air damper shall close, the fans will shut down, the heating valve shall open, and an alarm generated at the DDC front-end.

c. Whenever the unit's supply fan is off, the outside air damper shall be fully closed.

d. Occupied/unoccupied cycle determination will be made via the BMS front-end.

e. All setpoints will be adjustable from the BMS front-end.

B. Occupied Hours (Heating Mode)

a. During occupied hours, H-V Unit shall be enabled:

i. The supply fan shall run continuously.

ii. Once the fan is proven running, the Outside air damper shall open to full 100% open outside air position (100% open – Minimum Outside Air Damper Position %)

b. Glycol Hot Water Coil

iii. New DDC modulating control valve shall modulate the supply air discharge temperature based on a new DDC duct thermostat (72 F adjust). Whenever the space temperature is below the space set point of (adjustable), the heating valve will be open to maintain the discharge air temperature at the discharge heating setpoint. The discharge air setpoint shall reset automatically between the discharge high

limit of 100°F (adjustable) and low limit of 60°F (adjustable) reset based on deviation of the space temperature from the space heating set-point. As the space temperature rises above the space set point (adjustable), the modulating hot water control valve shall modulate to slowly close to maintain the supply air duct temperature setpoint. The controller's program will maintain a minimum discharge temperature of 60°F (adjustable) by enabling the heating and modulating the outside air damper, beyond the minimum position required volumetric flow rate of outside air, in sequence without overlap.

c. In the event that RTU has a command to enable either the supply air fan, modulating control valve, return & outside air damper positions, new modulating hot water control valve is still disabled, or freeze stat trips on hot water duct coil, an alarm will be displayed on the BMS.

C. Unoccupied Hours (Heating Mode)

d. During unoccupied hours, H-V unit shall be off and Glycol Hot Water heating valve shall be open. Upon occupied sensors detecting that the spaces being served by unit are occupied during unoccupied hours, the H-V shall turn on and the glycol hot water control valve shall modulate to maintain a supply air discharge temperature setpoint of 72F (adj.):
   iv. Supply fan blower shall be enabled.
   v. Outside air damper shall be at 100% open
   vi. DDC modulating control valve shall modulate open to maintain the supply air discharge heating set point (72 F adj.).

e. In the event that H-V has a command to enable either the supply air fan, outside air damper position, new modulating hot water control valve is still disabled, or freeze stat trips on glycol hot water duct coil, an alarm will be displayed on the BMS.
   vii. DDC modulating control valve shall modulate open to maintain the heating set point.

f. In the event that RTU has a command to enable either the supply air fan, outside air damper positions, new modulating glycol hot water control valve is still

disabled, or freeze stat trips on glycol hot water duct coil, an alarm will be displayed on the BMS.

D. Interlocks
   a. New unit HV-LOCKER SUITE shall be interlocked with the following exhaust fan systems:
      i. EF-3
      ii. EF-4
      iii. EF-5
      iv. EF-6
      v. EF-7
   b. Sequence: Upon proof of EF-3, EF-4, EF-5, EF-6, and EF-7 motorized exhaust dampers opening, HV-LOCKER SUITE outside damper shall open to full. HV-LOCKER SUITE, EF-3, EF-4, EF-5, EF-6, EF-7 shall all energize.
   c. New unit HV-VISTING LOCKERS shall be interlocked with the following exhaust fan systems:
      i. EF-1
      ii. EF-2
   d. Sequence: Upon proof of EF-1, EF-2, motorized exhaust dampers opening, HV-VISITING LOCKER outside damper shall open to full. HV-VISITING LOCKER, EF-1, EF-2, shall all energize.

EXHAUST FAN SEQUENCE OF OPERATIONS:

EXHAUST FANS
EF-1
EF-2
EF-3
EF-4
EF-5
EF-6
EF-7

EXHAUST FANS (EF-TAGS LISTED IN TABLE)

A. General

a. Fan EF-Tag shall be in the “enabled” position during occupied hours.
b. Occupied hours shall be adjusted on BMS schedule menu (adj.).
c. All setpoints will be adjustable from the BMS front-end.

B. Occupied Hours

g. During occupied hours, EF-Tag Unit shall be enabled.
viii. Exhaust Fan shall run continuously.

C. Unoccupied Hours

h. During unoccupied hours, EF-Tag Unit shall be disabled.

D. Interlocks

a. New unit HV-LOCKER SUITE shall be interlocked with the following exhaust fan systems:
i. EF-3
ii. EF-4
iii. EF-5
iv. EF-6
v. EF-7
b. Sequence: Upon proof of EF-3, EF-4, EF-5, EF-6, and EF-7 motorized exhaust dampers opening, HV-LOCKER SUITE outside damper shall open to full. HV-LOCKER SUITE, EF-3, EF-4, EF-5, EF-6, EF-7 shall all energize.
c. New unit HV-VISTING LOCKERS shall be interlocked with the following exhaust fan systems:
i. EF-1
ii. EF-2
d. Sequence: Upon proof of EF-1, EF-2, motorized exhaust dampers opening, HV-VISITING LOCKER outside damper shall open to full. HV-VISITING LOCKER, EF-1, EF-2, shall all energize.

Rooftop Energy Recovery Units/ H&V Units / Cabinet Heaters / Fin Tube Elements				
Description	**Point**	**History**	**Alarm**	**Totalize**
Discharge Air Temperature	AI	X	X	
Mixed Air Temperature	AI	X	X	
Unit discharge RH	AI	X	X	
Unit discharge RH setpoint	AV	X		
Pre-Occupancy Purge Command	AV	X		
Pre-Occupancy Purge Max Runtime Allowed	AV	X		
Post-Flush Command	AV	X		
Post-Flush Max Runtime Allowed	AV	X		
Space Temperature	AI	X	X	
Space Relative Humidity	AI	X	X	

Outside Air Temperature	AV	X		
Occupied Space Temperature Heating Set Point	AV	X		
Occupied Space Temperature Cooling Set Point	AV	X		
Occupied Space Relative Humidity Set Point	AV	X		
Unoccupied Space Temperature Heating Set Point	AV	X		
Unoccupied Space Temperature Cooling Set Point	AV	X		
Active Temperature Setpoint	AV	X		
Active Relative Humidity Setpoint	AV	X		
Mixed Air Low Limit Set Point	AV	X		
Discharge Air Low Limit Set Point	AV	X		
Heating Command	AO	X		
Cooling Command	BO	X		
Outside Air Damper Command	AO	X		
Exhaust Air Damper Command	AO	X		
Return Air Damper Command	AO	X		
Dehumidification/Hot Gas Reheat Command	AO	X		
Supply Fan Status	BI	X	X	X
Supply Fan Command	BO	X	X	
Exhaust Fan Status	BI	X	X	X
Exhaust Fan Command	BO	X	X	
Occupied Command	BV			
Occupied Status	BV	X		
Status of DDC controller	BV		X	

END OF SECTION 23 09 93

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 231123 – FACILITY NATURAL-GAS PIPING

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of natural/liquefied petroleum gas piping system work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for natural/ liquefied petroleum gas piping systems include the following:

1. Building distribution system from the gas meter header, through the gas pressure regulator to building and gas fired equipment connections and above/underground liquefied petroleum gas piping and storage tank/s.

1.02 SUBMITTALS

A. Product data - submit manufacturer's data for fuel gas piping systems materials and products on the following:

1. Piping.
2. Valves.
3. Pressure Regulators
4. Roof Pipe Support

1.03 QUALITY ASSURANCE

A. ANSI code compliance - fabrication and installation shall comply with applicable provisions of ANSI B31.2 "Fuel Gas Piping".

B. Gas valves shall comply with ANSI Z21.15. Gas pressure regulators shall comply with ANSI Z21.18. Gas meters shall comply with ANSI B109.2 or B109.2.

C. ASTM code compliance - steel pipe shall comply with applicable provisions of ASTM A53 "specifications for pipe, steel, black and hot dipped, zinc-coated welded and seamless."

D. Plastic pipe may be used underground only and shall comply with applicable provisions of ASTM D 2513-90b "specification for thermoplastic gas pressure pipe, tubing, and fittings," and installation shall be in accordance with ASTM D 2774-72 "recommended practice for underground installation of thermoplastic pressure piping."

E. National fuel gas code compliance - comply with applicable provisions of NFPA 54 (ANSI Z223.1) "National Fuel Gas Code", New York State Fuel Gas Code and ANSI Z223.1a "Supplement to National Fuel Gas Code"; and NFPA 58 Liquefied Petroleum Gas Code.

F. Local utility compliance - comply with requirements of local gas utility company, NationalGrid Corporation for Natural Gas with a heating value of 1,000 BTU/cu ft. and a specific gravity 0.6; and Starlite Propane for Liquefied Petroleum Gas with a heating value of 2,500 BTU/cu ft. and a specific gravity 1.52.

G. Acceptable Manufacturers:

1. Black Steel Pipe.

    a. La Clede Steel Company.
    b. Sawhill Tubular Division.
    c. USS Division of USX Corporation.

2. Pipe Unions

    a. Crane.
    b. Dart.
    c. Jefferson.

3. Dielectric Unions

    a. Epco.
    b. Watts.
    c. Consolidated.

4. Pipe Thread Compound

    a. Crane.
    b. Dixon.
    c. Rutland.

5. Gas Stops

    a. Mueller.
    b. Hays.
    c. Lunkenheimer.
    d. Equimeter.

6. Pressure Regulators

    a. Equimeter.
    b. Fisher.
    c. Robertshaw.

PART 2 - PRODUCTS

2.01 NATURAL/ LIQUEFIED PETROLEUM GAS PIPING MATERIALS AND PRODUCTS

A. General - provide piping materials and factory fabricated piping products as indicated. Where not indicated, provide proper selection. Provide materials and products complying with ANSI B31.2 where applicable; base pressure rating on natural gas piping system maximum design pressures. Where more than one type of materials or products are indicated, selection is Installer's option.

B. Comply with other Division 23 sections for:

    1. Building distribution piping - plastic pipe markers.
    2. Gas valves - valve tags.
    3. Gas service - underground type plastic line markers.

C. Piping specialties

    1. Provide piping specialties complying with Division 22 Basic Materials and Methods section

"Piping Specialties", in accordance with the following listing:

a. Pipe escutcheons.
b. Pipe sleeves.
c. Dielectric unions
d. Sleeve seals.

D. Basic Supports and anchors

1. General – provide supports and anchors complying with Division 22 Basic Material and Methods section "Supports and Anchors".

2.02 BASIC PIPE, TUBE AND FITTINGS

A. General - Comply with Division 22 section "Basic Mechanical Materials and Methods" for pipe joining materials.

B. Gas service piping: (above ground)

1. All pipe sizes - black steel pipe.
2. Pipe weight - Schedule 40 complying with ASTM A53.

a. Screwed galvanized malleable iron fittings, class 150 for size 2" and smaller.
b. Fittings - wrought steel butt welding, class 150 for size 2½" and larger.

C. Gas service piping: (below ground)

1. Pipe sizes 1/2" through 12" - thermoplastic gas pressure pipe, tubing and fittings complying with ANSI/ASTM D 2513.

D. Building distribution piping:

1. Pipe size 2" and smaller - black steel pipe.

a. Pipe weight - Schedule 40, complying with ASTM A53.
b. Fittings - malleable iron threaded or socket welded.

2. Pipe sizes 2 1/2" and larger - black steel pipe.

a. Pipe weight - Schedule 40, complying with ASTM A53.
b. Fittings - wrought-steel butt welding.

2.03 GAS VALVES

A. General - gas valves required for natural gas piping systems include the following types:

1. Gas cocks:

a. Gas cocks 2" and smaller - 150 psi non-shock WOG, bronze straightway body, bronze tapered plug, square head, lubricated, locking lever handle, threaded ends.

b. Gas cocks 2 1/2" and larger - 125 psi non-shock WOG, iron body straightway, square head, flanged ends, lubricated plug cock, tapered plug, washer and locking lever handle.

2. Safety Shut-Off Gas Solenoid Valves (Science Labs / where applicable)

a. Safety shut-off valves shall be normally closed aluminum body with BUNA N Seating, explosion-proof solenoid enclosure, UL FM approval, 80V DC operation. ASCO model Series 8215.

b. Each valve shall be equipped with a relay panel, 120V AC input, 80V DC output. ASCO Catalog No. 108D10C or equal.

c. Each valve and control panel for laboratory bench gas outlet use shall also be supplied with a control station with a mushroom push button (push to open) momentary contact and a key operated switch. Control panel shall mount in the Instructors Laboratory Table. Control station shall be ASCO Catalog No. 216B89 or equal.

B. Manufacturer - subject to compliance with requirements, provide gas cocks of one of the following:

1. Lunkenheimer Co.
2. Homestead Industries, Inc., Valve Div.
3. Equimeter.
4. Nordstrom Valves, Inc.
5. Mueller Co.
6. Kenotest Manufacturing Corp.

2.04 PRESSURE REGULATORS

A. Description: Regulators shall be a low pressure type designed for 10 psi maximum and an outlet pressure range from 0-28” water column, with threaded ends for 2 inch and smaller, flanged ends for 2 ½” and larger, for inlet and outlet gas pressures, specific gravity and volume flow indicated.

B. Materials of Construction shall be:

1. Cast Iron Case.
2. Brass Valve Seat.
3. Leather or synthetic Valve Washer.
4. Leather or synthetic diaphragm.

C. Size as recommended by the manufacturer.

D. Make: Equimeter Model 143.

2.05 ROOF PIPE SUPPORTS

A. Description: A “roller-bearing” pipe support used to support roof mounted gas pipes. Design shall absorb thermal expansion and contraction of pipes and prevent damage to the roof membrane. Pipes shall rest on a nylon roller situated in a polycarbonate resin seat. Each pipe stand will accommodate up to 4 1/4" outside diameter pipes. The “U” shaped cradle shall keep the pipe stand roller system directly beneath the pipe without binding. Guide holes shall be provided at the top of the cradle for loose installation of an aluminum pipe strap using 1/2" #10 screws to prevent separation of the pipe from the support. The base shall be gently rounded to prevent gouging with edges raised 2" providing a platform whereby various elevations may be achieved by stacking several pipe stands one upon the other. Two 1/2" drainage ports shall be provided to prevent ponding within the device.

B. Composition and Materials: The pipe stand shall consist of 3 major components. (1) A one-piece roof deck base, pipe support and roller housing composed of rigid poly carbonate plastics, and (2) A roller made of nylon which rests within the roller housing.

C. Size: The deck base shall be 7 1/2" square, the stacking platform shall be 2" high, the top of the roller device shall be 2 5/8" high, the top of the cradle shall be 4" high, and the maximum width of the interior of the cradle shall be 4 1/4". Pipes supported one pipe stand high will have a clearance of 2 5/8". Each stacking layer increases the clearance by 2".

D. Make: MIRO Industries PILLOW BLOCK PIPESTAND MODEL NO. 24-R or approved equal. MIRO INDUSTRIES, INC., 586 West 8360 South, Sandy, Utah 84070 Phone (800) 768-6978 Fax (800) 440-7958.

PART 3 - EXECUTION

3.01 INSTALLATION OF NATURAL/ LIQUEFIED PETROLEUM GAS PIPING MATERIALS AND PRODUCTS

A. General: Install the following in accordance with Division 15A section, "Basic Mechanical Materials and Methods".

1. Identification.
2. Piping specialties.
3. Supports, anchors and seals.

3.02 INSTALLATION OF NATURAL/ LIQUEFIED PETROLEUM GAS PIPING

A. General: Install in accordance with Division 15A Section "Basic Mechanical Materials and Methods".

B. Install in accordance with applicable codes and local utility company requirements. For buried gas service piping, prepare trench per General Provisions section. Install underground piping not less than 24" below finished grade.

C. Never run gas piping underground below building slab.

D. Use non-hardening sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

E. Remove cutting and threading burrs before assembling piping.

F. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.

G. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

H. Install drip legs in gas piping where indicated, and where required by code or regulation.

I. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.

J. Use dielectric unions where dissimilar metals are joined together.

K. Install piping with .6" drop in 100' pipe run in direction of flow.

L. Install piping parallel to other piping, but maintain minimum of 12" clearance between gas piping and steam or hot water piping above 200 degrees F (93 C).

M. Exterior gas piping shall be fully painted using exterior grade resin type paint, bright yellow.

3.03 ROOF PIPE SUPPORT INSTALLATION

A. To install the pillow block pipe stands, (1) center the pipe stand beneath the pipe so that the cradle allows the pipe to be squarely over and through the cradle of the pipe stand. (2) Set the pipe in the pipe stand without dropping or causing undue impact. An additional sheet of roofing material, a traffic pad, or a MIRO Deck Plate shall be installed beneath the pipe stand. For built-up roofs, all loose aggregate from an area 10" square should be removed from the area directly beneath the pipe stand and then follow the installation directions set forth above.

B. The pipe shall be secured to the pipe stand by using an aluminum Pipe Strap and #10 stainless steel screws in the guide holes at the top of each pipe stand. Note: allow sufficient room between the pipe and the strap to provide for free movement of the pipe without binding.

C. Pipe support spacing shall be 10 feet on center. Each pipe stand shall be properly elevated to even load weight at all pipe stands.

3.04 NATURAL/ LIQUEFIED PETROLEUM GAS SERVICE INSTALLATION

A. Arrangements for gas service to the building shall be by the plumbing Contractor. (NationalGrid for natural gas; Starlite Propane for liquefied petroleum gas)

B. New meter/s, pressure regulator/s and gas piping to building by Division 22.

C. Comply with regulations of the local utility company: NationalGrid (Keyspan) Corporation for natural gas and Starlite Propane for Liquefied Petroleum Gas.

3.05 WELDING

A. Conform to ANSI B31.8 Code for Pressure Piping - Gas Transmission and Distribution Piping Systems, 2-49.1 Safety in Welding and Cutting and utility regulations.

B. Pipe to be cleaned free of rust and scale, single be joint, bevel cut both ends.

C. Use backing rings on 3" pipe and larger.

D. Mitered pipe and field fabricated fittings not allowed.

E. Branch connections may be vee-butt welded directly to main without fittings provided two or more sizes smaller than main and branches not extending inside main.

3.06 INSTALLATION OF VALVES

A. Gas cocks - provide at connection to gas train for each gas fired equipment item, and on risers and branches where indicated.

B. Locate gas cocks where easily accessible and where they will be protected from possible injury.

C. Safety Shut-off Valves at Labs – furnish relay panel (Control Panel) and control station to Div. 26 for installation and Wiring. Div. 22 shall install solenoid valves in gas piping.

3.07 PIPING TESTS

A. Test and purge gas piping in accordance with ANSI B31.2, N.B.F.U., and local utility requirements and per specification section 15985A Plumbing Testing, Adjusting and Balancing. Low pressure

gas piping test shall be run for a minimum duration of one hour at 15 psi pressure, (or 2-1/2 time the operating pressure for systems over 5 psi). In addition, plumbing contractor shall conform to all requirements of NationalGrid (Keyspan) for natural gas and Starlite Propane for Liquefied Petroleum Gas.

NOTE:

1. **All gas piping to be in compliance with NYS Fuel Gas Code, local codes and guidelines; and be installed by licensed personnel.**

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 232113 – HYDRONIC PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of hot and / or chilled water piping systems work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for hot/chilled water piping systems include the following:

1. Hot/chilled water piping systems for hot/chilled water heating/cooling terminal units.

2. Hot/chilled water piping systems for hot/chilled water coils in air handling units.

C. Refer to appropriate Division 23 sections for insulation required in connection with hot/chilled water piping systems.

1.03 QUALITY ASSURANCE

A. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of hot/chilled water piping systems.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data for hot/chilled water piping systems, materials and products.

B. Shop Drawings: Submit scaled layout drawings of installed hot/chilled water pipe and fittings including, but not necessarily limited to, pipe sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS

2.01 HOT/CHILLED WATER PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings and capacities as indicated. Where not indicated, provide proper selection as determined by engineer to comply with installation requirements.

B. Provide materials and products complying with ANSI B31.1 Code for Power Piping where applicable, base pressure rating on hot/chilled water piping systems maximum design pressures. Provide sizes and types matching piping and equipment materials used in hot/chilled water piping systems. Where more than one type of material or product is indicated, selection is engineer’s option.

2.02 BASIC IDENTIFICATION

A. General: Provide identification complying with Division 23 Basic Materials and Methods section "Mechanical Identification."

2.03 BASIC PIPE, TUBE AND FITTINGS

A. General: Provide pipe, tube and fittings complying with Division 15 Basic Materials and Methods section "Pipe, Tube and Fittings," in accordance with the following listing:

1. Hot/chilled water AND low pressure steam piping:

    a. Pipe size 2" and smaller: Black steel pipe.

        1) Pipe weight: Schedule 40.
        2) Fittings: Class 125 cast iron threaded.

2. Pipe size 2-1/2" and larger: Black steel pipe.

        1) Pipe weight: Schedule 40.
        2) Fittings: Wrought steel buttwelding.

2.04 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division 23 Basic Materials and Methods section "Piping Specialties."

2.05 BASIC SUPPORTS, ANCHORS AND SEALS

A. General: Provide supports, anchors and seals complying with Division 23 Basic Material and Methods section "Supports, Anchors, and Seals." Supports and anchors provided shall meet the requirements of section 1613 of the New York State Building Code; horizontal and vertical runs of pipe shall be securely supported in accordance with the New York State Building Code including seismic requirements.

2.06 BASIC VALVES

A. General: Provide valves complying with Division 23 Basic Materials and Methods section "Valves," in accordance with the following listings:

1. Sectional Valves:

    a. 2" and smaller: Ball valves (hot/chilled water only).
    b. 2-1/2” and larger: rising stem or O.S.&Y. type.
    c. 2-1/2: and larger: Butterfly valves

2. Shutoff Valves:

    a. 2" and smaller: Ball valves (hot/chilled water only)
    b. 2-1/2" and larger: Rising stem or O.S.&Y. valves. Butterfly valves may be used.

3. Heating/Cooling Terminal Outlet Valves:

    a. 2" and smaller: Balance valve (Globe type)(hot/chilled water only)
    b. 2-1/2" and larger: Rising Stem.(Globe type).

4. Drain Valves:

    a. 2" and smaller: Ball valves.

5. Check Valves:

    a. All sizes: Silent wafer type check valve, swing type check valve.

2.07 BASIC EXPANSION COMPENSATION

A. General: Provide expansion compensation products complying with Division 23 "Expansion Compensation," in accordance with the following listing:

1. Flexible ball pipe joints (hot/chilled water only) Use fabricated piping loops for low pressure steam or linear bellows type rated for steam service.
2. Pipe alignment guides and anchors.

2.08 BASIC THERMOMETERS AND GAUGES

A. General: Provide meters and gauges complying with Division 23 section "Thermometers and Gauges," in accordance with the following listing:

1. Temperature gauges and fittings.
2. Pressure gauges and fittings.
3. Flow measuring gauges.

2.09 HYDRONIC SPECIALTIES

A. General: Provide hydronic specialties complying with Division 23 section "Hydronic Specialties," in accordance with the following listing:

1. Balance valves.
2. Balance cocks.
3. Vent valves.
4. Flow control valves.
5. Diverting fittings.
6. Air separators.

2.10 UNDERGROUND PIPING

A. General:

1. All underground heating water lines shall be XTRU-THERM as manufactured by PERMA-PIPE. All straight sections shall be factory fabricated, insulated, and jacketed. The piping system design and manufacture shall be in strict conformance with ASME B31.1, latest edition. The piping manufacturer will be responsible for the design and thermal expansion of the system. Installation of the piping system shall be in accordance with the manufacturer’s instructions. Factory trained field technical assistance shall be provided for critical periods of installation, unloading, field joint instruction and testing.

B. Service Pipe:

1. The service pipe shall be ASTM A53 Schedule 40 Grade B Carbon Steel. Straight sections shall be supplied in 20 or 40-foot lengths with piping exposed at each end for field joint fabrication.

C. Insulation:

1. The service pipe insulation shall be polyurethane foam with 2 lb/ft^3 minimum density, 90% minimum closed cell content, minimum compressive strength of 40 psi and initial thermal conductivity of 0.18 Btu-in/hr/ft^2/^{O}F. The insulation shall completely fill the annular space between the service pipe and jacket and-shall be bonded to both. Systems using open cell insulation or a non- bonded design shall not be allowed. The polyurethane foam insulation shall be tested by the manufacturer for mechanical and thermal s to assure compliance with the above values. All test samples will be taken from production material, identified, tagged and tested in accordance with the table below. Test reports showing results will be furnished to the engineer for approval. Data supplied by the polyurethane foam chemical supplier is not acceptable.

Attribute	ASTM STD	Sample Frequency	Requirement
Insulation Density	D 1622	Once per shift	$\geq$ 2 lb/ft^3
Insulation Compression Strength	D 1621	Once per shift	$\geq$ 40 psi
Insulation Closed Cell Content	D 2856	Once per shift	$\geq$ 90%
Insulation Thermal Conductivity	C 518	Once per shift	< 0.18 Btu-in/hr/ft^2/°F

The insulation shall be provided to the minimum thickness specified below:

Pipe Size (in.)	Minimum Insulation Thickness (in.)	
	Chilled Water	Glycol Water
1 to 12	1.5	1.5

D. Insulation Jacket:

1. The outer protective insulation jacket shall be seamless high-density polyethylene (HDPE) in accordance with ASTM D3350, minimum cell classification PE345444C. PVC or tape materials are not allowed. The end of each straight section of pipe will have the jacket tapered down over the insulation and bonded to the service pipe. No mastic is allowed. The minimum thickness of the HDPE jacket shall be as follows:

Jacket OD (in.)	Minimum Jacket Thickness (in.)
OD < 12	0.120

E. Fittings:

1. All fittings shall be factory prefabricated and pre-insulated. Straight tangent lengths shall be added to all ends so that all field joints are at straight sections of pipe. Elbow jackets shall be molded HDPE. Tee jackets shall be extrusion welded or butt fusion welded HDPE. Gluing, taping or hot air welding shall not be allowed.

F. Field Joints:

1. The service pipe shall be hydrostatically tested to 150 psig or 1 1/2 times the design pressures whichever is greater. Insulation shall then be poured in place into the field joint area. All field-applied insulation shall be placed only in straight sections of pipe. The installer shall seal the field joint area with a heat shrinkable adhesive backed sleeve. Backfilling shall not begin until the heat shrink sleeve has cooled. All insulation and jacketing materials for the field joint shall be furnished by PERMA-PIPE.

G. Field Service:

1. The piping manufacturer will provide a factory field service technician to be present during critical periods of the installation. The factory field service technician will be employed by the piping manufacturer and will not be a sales representative.

H. Backfill:

1. A 4-inch layer of sand or fine gravel shall be placed and tamped in the trench to provide a uniform bedding for the pipe. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated pipe. The remaining trench shall be evenly and continuously backfilled and compacted in uniform layers with suitable excavated soil.

PART 3 - EXECUTION

3.01 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division 23 Basic Materials and Methods section "Mechanical Identification."

3.02 INSTALLATION OF HOT/CHILLED WATER WATER DISTRIBUTION PIPING

A. General: Install water distribution piping in accordance with Division 23 Basic Materials and Methods section "Pipe, Tube and Fittings."

B. Install concentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush.

C. Install piping with 1" minimum rise in 40' pipe run (0.2%) in direction of flow.

D. Connect branch feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.

E. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.03 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division 23 section "Hydronic Specialties."

3.04 INSTALLATION OF SUPPORTS, ANCHORS AND SEALS

A. Install supports, anchors and seals in accordance with Division 15 Basic Materials and Methods and project drawings and details.

3.05 INSTALLATION OF VALVES

A. Install valves in accordance with Division 23 section "Valves."

B. Sectional valves: Install on each branch and riser, close to main, where branch or riser serves two or more heating terminals or equipment connections and elsewhere as indicated.

C. Shutoff valves: Install on inlet and outlet of each mechanical equipment item and on inlet of each heating/cooling terminal and elsewhere as indicated.

D. Heating/cooling terminal outlet valves: Install on outlet of each heating/cooling terminal and elsewhere as indicated.

E. Drain valves: Install on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system and elsewhere where indicated or required to completely drain hot/chilled water piping system.

F. Check valves: Install on discharge side of each pump and elsewhere as indicated.

3.06 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS

A. Install expansion compensation products in accordance with Division 23 section "Expansion Compensation."

3.07 INSTALLATION OF THERMOMETERS AND GAUGES

A. Install thermometers and gauges in accordance with Division 23 section "Thermometers and Gauges."

3.08 INSTALLATION OF HYDRONIC SPECIALTIES

A. General: Install hydronic specialties in accordance with Division 23 "Hydronic Specialties" section.

3.09 EQUIPMENT CONNECTIONS

A. General: Connect hot/chilled water piping system to mechanical equipment as indicated and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return, drain valve on drain connection.

B. Hot/chilled water terminals: Install hot/chilled water terminals with heating/cooling terminal outlet valve and union on outlet, union, shutoff valve on inlet. Install automatic air vent valve on element in accordance with manufacturer's instructions. Locate valves and balancing cocks behind valve access doors for ease of maintenance. Where indicated, install automatic temperature control valve with unions between all ports of the control valve.

3.10 CLEANING, FLUSHING AND INSPECTING

A. General: Include coils, etc. See Division 23 Basic Materials & Methods.

3.11 TESTING AND BALANCING

A. General: See Division 23 "Testing, Adjusting and Balancing.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 232116 – HYDRONIC SPECIALTIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of hydronic specialties required by this section is indicated on drawings, and/or specified in other Division 23 hydronic piping system sections.

B. Types of hydronic specialties specified in this section include the following:

1. Balance valves.
2. Vent valves.
3. Flow control valves.
4. Diverting fittings.
5. Air separators.
6. Compression tanks.
7. Pump discharge valves.
8. Shot feeders.
9. Water relief valves.
10. Pressure reducing valves.
11. RPZ – Backflow Preventer

1.03 QUALITY ASSURANCE

A. Materials and equipment shall be provided by one of the manufactures listed in Part 2 - Products. Materials and equipment from other manufacturers may be accepted if proven equal to those specified. This contractor is liable for and shall pay for all architectural and engineering review and redesign costs for substitute materials and equipment. This contractor also is liable for all costs of changes in the work required by substitute equipment.

B. The length of time the manufacturer has been in business, the location and capability of complete repair facilities, availability of repair parts and annual maintenance contracts all will be considered in determining equality. Refer to requirements pertaining to substitute materials and equipment.

1.04 SUBMITTALS

A. Product data - submit catalog cuts, specifications, installation instructions and dimensioned drawings for each type of manufactured hydronic specialty. Include pressure drop curve or chart for each type and size of hydronic specialty.

B. Shop drawings - submit for fabricated specialties, indicating details of fabrication, materials and method of support.

C. Maintenance data - submit maintenance data and spare parts lists for each type of manufactured hydronic specialty. Include this data in maintenance manual.

D. Hydronic specialty types - provide hydronic specialties of same type by same manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURED HYDRONIC SPECIALTIES

A. General - provide factory fabricated hydronic specialties recommended by manufacturer for use in service indicated. Provide hydronic specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by the engineer to comply with installation requirements. Provide sizes as indicated and connections which properly mate with pipe, tube and equipment connections. Where more than one type is indicated, selection is the engineers' option, but more than one type cannot be used on project.

B. Balance valves:

1. General - provide balance valves as indicated, of one of the following types:

   a. Threaded ends 2" and smaller - Class 125, bronze body, ball valve with memory stop.
   b. Soldered ends 2" and smaller - Class 125, bronze body, ball valve with memory stop.
   c. Threaded, soldered, of flanged end globe style providing three (3) functions:

      1) Precise flow measurement
      2) Precision flow balancing
      3) Positive shut-off, no drip seat, Teflon disk, 1-1/2" to 2" size - drain connection with protective cap.
      4) Vernier-type setting with "hidden memory" feature to program valve for tamper-proof setting. Balance meter, valved connections. Manufacturer: Armstrong Pumps, Type CBV.

C. Vent valves:

1. Manual vent valves - provide manual vent valves designed to be operated manually with screwdriver or thumbscrew, 1/8" N.P.T. connection.

2. Automatic vent valves - provide automatic vent valves designed to vent automatically with float principle, stainless steel float and mechanisms, cast iron body, pressure rated for 125 psi, 1/2" N.P.T. inlet and outlet connections.

3. Manufacturer - subject to compliance with requirements, provide vent valves of one of the following:

   a. Bell & Gossett, ITT Fluid Handling Div.
   b. Taco, Inc.
   c. Armstrong Co.

D. Flow control valves:

1. General - provide flow control valves pressure rated for 125 psi, containing lift check assembly which will automatically open by means of pump flow pressure, and automatically close when pump is not operating. Provide with means to manually open in case of pump failure.

   a. Threaded ends 2" and smaller - cast iron body, bronze check mechanism, screw-in bonnet, straight or angle pattern.
   b. Soldered ends 1 1/4" and smaller - cast bronze body, bronze check mechanism, screw in bonnet, straight or angle pattern.
   c. Threaded ends 2 1/2" through 4" - cast iron body, bronze check mechanism, screw in bonnet, straight or angle pattern.

2. Manufacturer - subject to compliance with requirements, provide flow control valves of one of the following:

    a. Bell & Gossett, ITT Fluid Handling Div.
    b. Taco, Inc.
    c. Armstrong Pump Co.

E. Diverting fittings:

1. General - provide diverting fittings as indicated for one pipe hydronic piping systems. Construct fittings of cast iron with threaded ends or wrought copper with solder ends, pressure rated for 125 psi. Provide indication on fitting of direction of flow for supply or return applications. Furnish flow and pressure drop curves based on manufacturer's testing with submittal.

2. Manufacturer - subject to compliance with requirements, provide diverting fittings of one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett, ITT Fluid Handling Div.

F. Air Separators:

1. General – provide air separators pressure rated for 125 psi. Select capacity based on total system gpm.

2. Dip tube fittings – provide dip tube fittings in boilers as indicated to prevent free air collected in boiler from rising into system.

3. In-Line air separators – provide in-line air separators as indicated. Construct sizes 1 1/2” and smaller of cast iron, and sizes 2” and larger of steel complying with ASME Boiler and Pressure Vessel Code and stamped with” U” symbol. Furnish National board Form U-1 denoting compliance.

4. Combination separator/strainer – provide external combination air separators/strainers as indicated. Construct of steel complying with ASME Boiler and Pressure Vessel Code and stamped with “U” symbol. Furnish National Board Form U-1 denoting compliance. Provide galvanized steel integral strainer with 3/16” perforations and free area of not less than 5 times cross sectional area of connecting lines. Provide tangential inlet and outlet connections and internal stainless steel air collector tube designed to direct released air into compression tank. Provide blowdown connections.

5. Manufacturer – subject to compliance with requirements, provide air separators of one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gosett, ITT Fluid Handling Div.
    c. Taco, Inc.

G. Compression tank:

1. General – provide compression tanks of size and number as indicated. Construct of steel for 125 psi pressure rating complying with ASME Boiler and pressure Vessel Code and stamped with” U” symbol. Furnish National Board Form U-1 denoting compliance. Provide tappings in bottom of tank for tank fitting.

a. Tank fittings – provide tank fittings for compression tanks as indicated, sized for compression tank diameter. Design tank fittings for 125 psi pressure rating and include manual vent to establish proper air volume in tank on initial fill.

2. Manufacturer – subject to compliance with requirements, provide compression tanks and tank fittings of one of the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett, ITT Fluid Handling Div.
   c. Taco, Inc.

H. Diaphragm type compression tanks:

1. General – provide diaphragm compression tanks of size and number as indicated. Construct tank of welded steel, constructed, tested and stamped in accordance with Section VII of the ASME Boiler and Pressure Vessel Code for a working pressure of 125 psi. Furnish National Board Form U-1 denoting compliance. Support vertical tanks with steel legs or base, support horizontal tanks with steel saddles. Provide specially compounded flexible diaphragm securely sealed into tank to permanently separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air charging fitting.

2. Manufacturer – subject to compliance with requirements, provide diaphragm type compression tanks of the following:

   a. Bell & Gossett, ITT Fluid Handling Div.
   b. Armstrong Pumps, Inc.

I. Pump discharge valves:

1. General – provide pump discharge valves as indicated. Provide Non-slam check valve with spring loaded disc and calibrated adjustment feature permitting regulation of pump discharge flow and shutoff. Provide flanged cast iron valve body, pressure rated for 175 psi, maximum operating temperature of 300 degrees F. Provide straight or angle pattern as required.

2. Manufacturer – subject to compliance with requirements, provide Pump discharge valves of one of the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett, ITT Fluid Handling Div.

J. Shot feeders:

1. General – provide shot feeders of 5 gallon capacity or otherwise as indicated, constructed of cast iron or steel, for introducing chemicals in hydronic system. Provide funnel and valve on top for loading drain valve in bottom, and recirculating valves on side. Construct for pressure rating of 125 psi.

2. Manufacturer – subject to compliance with requirements, provide shot feeders of one of the following:

   a. Culligan USA
   b. Laboratories, Subsidiary of Clow Corp.
   c. Mougul Div., The Dexter Corp.

K. Water relief valves:

1. General – provide water relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

   a. Combined pressure temperature relief valves – bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F (99 C) and pressure relief as indicated on drawing.
   b. Pressure relief valves – bronze body, test lever, ASME rated. Provide pressure relief at as indicated on drawing.

2. Manufacturer – subject to compliance with requirements, provide water relief valves of one of the following:

   a. Bell & Gossett, ITT Fluid Handling Div.
   b. Taco, Inc.
   c. Armstrong Pump Co.

L. Pressure Reducing Valves:

1. General – provide pressure reducing valves as indicated, of size and capacity as selected by Installer to maintain operating pressure on boiler system.

2. Construction – brass body, low inlet pressure check valve, inlet strainer removable without system shutdown, non-corrosive valve seat and stem, factory set at operating pressure.

3. Manufacturer – subject to compliance with requirements, provide pressure reducing valves of one of the following:

   a. Bell & Gossett, ITT Fluid Handling Div.
   b. Taco, Inc.
   c. Armstrong Pumps, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Balance valves:

1. General - Install on each hydronic terminal and elsewhere as indicated.

B. Vent valves:

1. Manual vent valves - install manual vent valves on each hydronic terminal at highest point, and on each hydronic piping drop in direction of low for mains, branches and runouts and elsewhere as indicated.

2. Automatic vent valves - install automatic vent valves at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain, or as indicated.

C. Flow control valves:

1. General - install flow control valves on discharge of each pump serving a hot water heating system or zone and elsewhere as indicated. Install in upright position in a horizontal line with adequate clearance for service and replacement. Adjust flow sensitivity for automatic operation.

D. Diverting fittings:

1. General - install diverting fittings as indicated and in accordance with manufacturer's instructions. Position fittings on supply and return mains with proper orientation for flow.

E. Air separators:

1. Dip tube fittings – install dip tube fittings in boiler outlet in accordance with manufacturer's instructions. Run piping to compression tank pitched towards tank at 1" rise in 5' runs (1.7%).

2. In-Line air separators – install in-line air separators in pump suction lines. Connect inlet and outlet piping. Run piping to compression tank pitched towards tank at 1" rise in 5' run (1.7%). Install drain valve on units 2" and over.

3. Combination separator/strainer – install external combination separators/strainers in pump suction lines. Connect inlet and outlet piping. Run piping to compression tank pitched towards tank at 1" rise in 5' run (1.7%). Install blowdown valve and piping. Remove and clean strainer after 24 hours and again after 30 days of system operation.

F. Compression tanks:

1. General – install compression tanks on trapeze hangers sized for tank fully loaded, or otherwise as indicated. Install tank fitting and drain valve in tank bottom and charge tank in accordance with manufacturer's instructions.

G. Diaphragm type compression tanks:

1. General – install diaphragm type compression tanks on floor as indicated, in accordance with manufacturer's instructions. Vent and purge air from hydronic system, charge tank with proper air charge as recommended by manufacturer.

H. Pump discharge valves:

1. General – at engineers option, install pump discharge valves on each pump discharge line in lieu of separate shutoff valve, check valve, and balance cock. Install in horizontal or vertical position with stem in upward position, allow clearance above stem for check mechanism removal. After hydronic system has been completed, mark calibrated name plate with stripe of yellow lacquer to permanently mark final balanced position.

I. Shot feeders:

1. General – install shot feeders on each hydronic system at pump discharge and elsewhere as indicated. Install in upright position with top of funnel not more than 48" above floor. Install in pump discharge line as indicated.

J. Water relief valves:

1. General – Install on hot water generators and elsewhere as indicated. Pipe discharge to floor. Comply with ASME Boiler and Pressure Vessel Code. Cut discharge pipe at 45° angle.

K. Pressure reducing valves:

1. Install for each hot water boiler or heat exchanger as indicated, and in accordance with manufacturer's installation instructions.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 232123 – HYDRONIC PUMPS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contractor, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Pumps required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Pumps specified in this section include the following:

1. In-Line Booster.
2. In-Line Circulator.
3. Vertical In-Line.
4. Frame-Mounted End Suction.
5. Close-Coupled End Suction.

C. Refer to appropriate Division 23 section for motor starters, disconnects and wiring of pump motors, not work of this section.

D. Refer to appropriate Division 23 sections for valves, gauges, strainers, vibration isolation bases, flexible pipe connectors for pumps, not work of this section.

1.03 QUALITY ASSURANCE

A. Materials and equipment shall be provided by one of the manufacturers listed in Part 2 - Products. Materials and equipment from other manufacturers may be accepted if proven equal to those specified. This contractor is liable for and shall pay for all architectural and engineering review and redesign costs for substitute materials and equipment. This contractor is also liable for all costs of changes in the work required by substitute equipment.

B. The length of time the manufacturer has been in business, the location and capability of complete repair facilities, availability of repair parts and annual maintenance contracts all will be considered in determining equality.

C. Refer to Division 01 of the project manual for requirements pertaining to substitute materials and equipment.

D. UL and NEMA Compliance - provide electric motors and products which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of pump. Include this data in maintenance manual.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle HVAC pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged HVAC pumps or components; replace with new.

B. Store HVAC pumps and components in clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide factory tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer.

2.02 IN-LINE BOOSTER PUMPS

A. General: Provide in-line booster pumps where indicated, of capacities scheduled.

B. Type: Horizontal, oil-lubricated, designed for 125 psi working pressure, 225 degrees F (107 degrees C) continuous water temperature, and specifically designed for quiet operation.

C. Body: Cast-iron.

D. Shaft: Steel, ground and polished, integral thrust collar.

E. Bearings: Two horizontal sleeve bearings designed to circulate oil.

F. Seal: Mechanical, with carbon seal face rotating against ceramic seat.

G. Motor: Open, drip-proof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.

H. Coupling: Self-aligning, flexible coupling.

I. Manufacturer: One of the following:

1. Taco
2. Armstrong Pumps, Inc.
3. Bell & Gossett ITT.

2.03 IN LINE CIRCULATOR PUMPS

A. General: Provide in-line circulator pumps where indicated, of capacities scheduled.

B. Type: Horizontal mount, vertical split case, oil-lubricated, designed for 125 psi working pressure, and 225 degree F (107 degree C) continuous water temperature.

C. Body: Cast iron, bronze fitted with suction and discharge gauge tappings.

D. Shaft: Hardened alloy steel.

E. Bearings: Oil-lubricated bronze journal bearings.

F. Seal: Mechanical, with carbon seal ring and ceramic seat.

G. Motor: Non-overloading at any point on pump curve, open, drip-proof oil-lubricated journal bearings, resilient mounted construction, built-in thermal overload protection on single phase motors.

H. Coupling: Self-aligning, flexible coupling.

I. Impeller: Enclosed type, hydraulically and dynamically balanced, and keyed to shaft.

J. Manufacturer: One of the following:

1. Taco
2. Armstrong Pumps, Inc.
3. Bell & Gossett ITT.

2.04 VERTICAL IN-LINE PUMPS

A. General: Provide vertical in-line pumps where indicated, of capacities scheduled.

B. Type: Vertical mount, in-line, close coupled, single stage, designed for 175 psi working pressure.

C. Body: Cast iron bronze fitted, 125 psi ANSI flanges of equal size, tappings for gauge and drain fittings.

D. Shaft: Steel with replaceable shaft sleeve.

E. Seal: Mechanical seal with ceramic seal seat.

F. Motor: Non-overloading at any point on pump curve, open, drip-proof, ball bearings, 15,000 hours bearing life, with lifting lug on top of motor.

G. Impeller: Enclosed type, hydraulically and dynamically balanced, keyed to shaft and secured with locking screw.

H. Manufacturer: One of the following:

1. Taco
2. Armstrong Pumps, Inc.
3. Bell & Gossett ITT.

2.05 FRAME MOUNTED END SUCTION PUMPS

A. General: Provide frame-mounted end suction pumps where indicated, of capacities, characteristics scheduled.

B. Type: Horizontal mount, single stage, vertical split case, flexible coupling, base mounted, designed for 175 psi working pressure.

C. Casing: Cast iron, bronze fitted, 125 psi ANSI flanges, tappings for gauge and drain connections.

D. Shaft: Steel with replaceable shaft sleeve.

E. Bearings: Regreasable ball bearings.

F. Seal: Mechanical, with carbon seal ring and ceramic seat.

G. Motor: Open, drip-proof, regreasable ball bearings.

H. Impeller: Enclosed type, hydraulically and dynamically balanced, keyed to shaft and secured with locking screw.

I. Baseplate: Structural steel with welded cross members, and open grouting area.

J. Coupling: Flexible, capable of absorbing torsional vibration, equipped with coupling guard.

K. Manufacturer: One of the following:

1. Taco
2. Armstrong Pumps, Inc.
3. Bell & Gossett ITT.

2.06 CLOSE-COUPLED END SUCTION PUMPS

A. General: Provide close-coupled end suction pumps where indicated, of capacities and characteristics scheduled.

B. Type: Horizontal mount, single stage, vertical split case, designed for 175 psi working pressure.

C. Casing: Cast iron, bronze fitted, 125 psi ANSI flanges, tappings for gage and drain connections.

D. Shaft: Steel with replaceable shaft sleeve.

E. Seal: Mechanical, with carbon seal ring and ceramic seat.

F. Motor: Open, drip-proof regreasable ball bearings.

G. Impeller: Enclosed type, hydraulically and dynamically balanced, keyed to shaft and secured with locking screw.

H. Manufacturer: One of the following:

1. Amtrol Inc., Thrush Div.
2. Armstrong Pumps, Inc.
3. Bell & Gossett ITT.

PART 3 - EXECUTION

3.01 INSTALLATION OF PUMPS

A. Install pumps where indicated, in accordance with manufacturer's published installation instructions, with recommended clearances provided for service and maintenance.

B. Install in-line pumps, supported from piping system, located for access to oil cups, service, and maintenance.

C. Install base-mounted pumps on minimum of 4" high (or as shown) reinforced concrete base equal or greater than 3 times total weight of pump and motor, with anchor bolts poured in place. Set and level pump, grout under pump base with non-shrink grout.

D. Provide piping accessories, hangers, supports, and anchors, valves, meters and gauges, vibration isolation, and equipment supports, as indicated for complete installation.

E. Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

F. Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

G. Ensure that pump units are wired properly, with rotation in correct direction, and that pump and motor grounding have been provided.

H. Refer to Division 23 section "HVAC Testing and Balancing" for pump system balancing.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 232213 – STEAM AND CONDENSATE PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes steam and condensate piping and specialties for systems up to 125 psig (860 kPa), inside the building.

B. Related Sections include the following:

1. Division 23 Section "Basic Materials and Methods" for general piping materials and installation requirements.
2. Division 23 Section "Valves" for general-duty gate, globe, ball, butterfly, and check valves.
3. Division 23 Section "Thermometers and Gages" for thermometers, flow meters, and pressure and vacuum gages.
4. Division 23 Section for labeling and identifying steam and condensate piping.
5. Division 23 for pipe supports, product descriptions and installation requirements. Hanger and support spacing specified in this section.
6. Division 23 “Automatic Temperature Controls” for temperature control, valves and sensors.

1.03 DEFINITIONS

A. HP Systems: High-pressure systems operating at 15 psig (104 kPa) or more.

B. LP Systems: Low-pressure systems operating at less than 15 psig (104 kPa).

1.04 SUBMITTALS

A. Product Data: For each type of special-duty valve and steam trap indicated, including rated capacities and accessories.

B. Shop Drawings: Detail flash tank assemblies and fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, and expansion joints and loops and their attachment to the building structure. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For steam traps, vacuum breakers, and meters, include in maintenance manuals as specified in Division 01.

1.05 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.

1.06 COORDINATION

A. Coordinate layout and installation of steam and condensate piping and suspension system components with other construction, including light fixtures, hydronic piping, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installation for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 23 for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Safety Valves:

    a. Armstrong International, Inc.
    b. Kunkle Inds. Inc.; Kunkle Valve Division.
    c. Spirax Sarco, Inc.
    d. Watts Industries, Inc.; Watts Regulators.

2. Pressure-Reducing Valves:

    a. Armstrong International, Inc.
    b. ITT Hoffman; ITT Fluid Technology Corp.
    c. Leslie Controls, Inc.
    d. Spence Engineering Company, Inc.
    e. Spirax Sarco, Inc.

3. Steam Traps:
    a. Armstrong International, Inc.

b. Barnes & Jones, Inc.
c. Dunham-Bush, Inc.
d. ITT Hoffman; ITT Fluid Technology Corp.
e. Spirax Sarco, Inc.
f. Sterling, Inc.

4. Air Vents and Vacuum Breakers:

a. Armstrong International, Inc.
b. Barnes & Jones, Inc.
c. ITT Hoffman; ITT Fluid Technology Corp.
d. Johnson Corp. (The).
e. Spirax Sarco, Inc.

5. Steam Meters:

a. EMCO Flowmeters.
b. ISTEC Corp.
c. Preso Meters Corp.
d. Spirax Sarco, Inc.

6. Condensate Meters:

a. Hersey Measurement Company.
b. ISTEC Corp.

2.02 PIPING MATERIALS

A. General: Refer to Part 3 piping application articles for applications of pipe and fitting materials.

2.03 STEEL PIPE AND FITTINGS

A. Steel Pipe:

1. Steel Pipe, NPS 2 (DN 50) and Smaller: ASTM A 53, Type S (seamless), Grade A, Schedules 40 and 80, black steel, plain ends.
2. Steel Pipe, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): ASTM A 53, Type E (electric-resistance welded), Grade A, Schedules 40 and 80, black steel, plain ends.
3. Steel Pipe, NPS 14 through NPS 18 (DN 350 through DN 450): ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 30, black steel, plain ends.
4. Steel Pipe, NPS 20 (DN 500): ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 20, black steel, plain ends.
5. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedules 40 and 80, black steel; seamless for NPS 2 (DN 50) and smaller and electric-resistance welded for NPS 2-1/2 (DN 65) and larger.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300.

C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250; raised ground face, and bolt holes spot faced.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.
4. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig (1035-kPa) minimum working pressure and 250 deg F (121 deg C) maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch (20-mm) misalignment.

H. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

I. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.04 VALVES

A. Gate, globe, check, ball, and butterfly valves are specified in Division 23 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

2.05 SAFETY VALVES

A. Size and Capacity: As required for equipment according to the ASME Boiler and Pressure Vessel Code.

B. Brass Safety Valves: Class 250, with threaded inlet and outlet; forged copper-alloy disc; fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

C. Cast-Iron Safety Valves: Class 250; forged copper-alloy disc with bronze nozzle; fully enclosed, cadmium-plated steel spring with adjustable pressure range and positive shutoff; raised-face flanged inlet and threaded outlet connections; factory set and sealed.

1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

D. Stop-Check Valves: Class 250, malleable-iron body and bonnet, cylindrical disc, removable liner and machined seat, brass-alloy stem, outside screw and yoke, polytetrafluoroethylene-impregnated packing with 2-piece packing gland assembly, flanged end connections, and cast-iron handwheel.

2.06 PRESSURE-REDUCING VALVES

A. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.

1. Valve Characteristics: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff. Valves shall have cast-iron body with threaded connections for valves NPS 2 (DN 50) and smaller and flanged connections for valves NPS 2-1/2 (DN 65) and larger; and

hardened stainless-steel trim, replaceable head and seat, main head stem guide fitted with flushing and pressure-arresting device, cover over pilot diaphragm, and non-asbestos gaskets.

2.07 STEAM TRAPS

A. Thermostatic Traps: Class 125, bronze angle-pattern body with integral union tailpiece and screw-in cap; balanced-pressure, stainless-steel or monel bellow element; and renewable, hardened stainless-steel head and seat.

B. Thermodynamic Traps: Stainless-steel body and screw-in cap; maximum operating pressure of 600 psig (4140 kPa); stainless-steel disc and seat; threaded ends.

1. Float and Thermostatic Traps: ASTM A 126, cast-iron body and bolted cap; renewable, stainless-steel float mechanism with renewable, hardened stainless-steel head and seat; maximum operating pressure of 125 psig (860 kPa); balanced-pressure, stainless-steel or monel thermostatic bellow element.
2. Thermostatic air vent capable of withstanding 45 deg F (25 deg C) of superheat and resisting water hammer without sustaining damage.
3. Inverted Bucket Traps: Cast-iron body and cap, pressure rated for 250 psig (1725 kPa); stainless-steel head and seat; stainless-steel valve retainer, lever, and guide pin assembly; and brass or stainless-steel bucket.
4. Strainer: Integral stainless-steel inlet strainer within the trap body.
5. Air Vent: Stainless-steel thermostatic vent.

2.08 THERMOSTATIC AIR VENTS

A. Quick Vents: Cast-iron or brass body, with balanced-pressure, stainless-steel or monel thermostatic bellows and stainless-steel heads and seats.

B. Float Vents: Cast-iron or brass body, seamless brass float, balanced-pressure thermostatic bellows, and replaceable stainless-steel seat, float, and head.

2.09 VACUUM BREAKERS

A. Vacuum Breakers: 150-psig (1035-kPa) steam working pressure, 365 deg F (185 deg C) maximum operating temperature, brass or stainless-steel body, and stainless-steel retainer, spring, and ball; with plain or threaded outlet.

2.10 STRAINERS

A. Y-Pattern Strainers: 250-psig (1725-kPa) working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen, No. 20 mesh for NPS 2 (DN 50) and smaller and manufacturer's recommended perforations for NPS 2-1/2 (DN 65) and larger; tapped blowoff plug. Threaded connections for strainers NPS 2 (DN 50) and smaller and flanged connections for strainers NPS 2-1/2 (DN 65) and larger.

B. Basket Strainers: 250-psig (1725-kPa) working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen; bolted cover; threaded connections for strainers NPS 2 (DN 50) and smaller and flanged connections for strainers NPS 2-1/2 (DN 65) and larger.

2.11 FLASH TANKS

A. Shop or factory fabricated of welded steel according to the ASME Boiler and Pressure Vessel Code, for 150-psig (1035-kPa) rating; and bearing ASME label. Fabricate with tappings for vents, low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.

2.12 METERS

A. Steam Meters: Pipeline sensor of modified venturi design, of stainless-steel construction, for insertion in pipeline between flanges, plus or minus 1 percent accuracy over full-scale deflection, producing pressure differential proportional to square of flow rate.

B. Steam Meters: Pipeline sensor with stainless-steel wetted parts and flange connections and with a piezoelectric sensor removable and serviceable without shutting down the process.

1. Turndown Ratio: At least 10:1 with plus or minus 1 percent accuracy over full flow range.
2. Microprocessor Enclosure: NEMA 250, Type 4.

C. Steam Meters: Pipeline sensor of spring-loaded, variable-area flowmeter type; density compensated; plus or minus 2 percent accuracy over full-scale deflection. Meters shall have a flow computer to display totalizer flow, flow rate, temperature, pressure, time, and date; alarms for high and low flow rate and temperature; and independent timers to store four peak flow rates and total flow. Computer shall have four, 20-mA output, ETA 232C, serial communication ports.

1. Condensate Meters: Brass body with threaded connections for meters NPS 2 (DN 50) and smaller and flanged connections for meters NPS 2-1/2 (DN 65) and larger; positive displacement turbine; magnetic coupling counter; suitable for temperatures up to 250 deg F (121 deg C) and for 250 psig (1725 kPa) working pressure.

PART 3 - EXECUTION

3.01 LP STEAM PIPING APPLICATIONS

A. Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40 steel pipe, with threaded joints using Class 125 cast-iron fittings.

B. Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Steam Piping, NPS 14 through NPS 18 (DN 350 through DN 450): Schedule 30 steel pipe, with welded joints using Schedule 30 wrought-steel welding fittings and Class 150 wrought-steel flanges.

D. Steam Piping, NPS 20 (DN 500): Schedule 20 steel pipe, with welded joints using Schedule 20 wrought-steel welding fittings and Class 150 wrought-steel flanges.

E. Condensate Piping, NPS 2 (DN 50) and Smaller: Schedule 80 steel pipe, with threaded joints using Class 125 malleable-iron fittings.

F. Condensate Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

3.02 HP STEAM PIPING APPLICATIONS

A. Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40 steel pipe, with threaded joints using Class 300 malleable-iron fittings.

B. Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Steam Piping, NPS 14 through NPS 18 (DN 350 through DN 450): Schedule 30 steel pipe, with welded joints using Schedule 30 wrought-steel welding fittings and Class 150 wrought-steel flanges.

D. Steam Piping NPS 20 (DN 500): Schedule 20 steel pipe, with welded joints using Schedule 20 wrought-steel welding fittings and Class 150 wrought-steel flanges.

E. Condensate Piping, NPS 2 (DN 50) and Smaller: Schedule 80 steel pipe, with threaded joints using Class 300 malleable-iron fittings.

F. Condensate Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

3.03 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Gate and ball valves.
2. Throttling Duty: Globe and ball valves.

B. Install shutoff-duty valves at each branch connection to supply mains, at inlet connection to each steam trap, and elsewhere as indicated.

3.04 LP STEAM-TRAP APPLICATIONS

A. Thermostatic Traps: Convectors and finned-tube radiation.

B. Float and Thermostatic Traps: Steam main and riser drip legs, laundry equipment, kitchen equipment, heat exchangers, and heating coils.

3.05 HP STEAM-TRAP APPLICATIONS

A. Thermostatic Traps: Convectors and finned-tube radiation.

B. Inverted Bucket Traps: Steam main and riser drip legs, and laundry equipment.

C. Float and Thermostatic Traps: Kitchen equipment, heat exchangers, and heating coils.

D. Thermodynamic Traps: Steam main and riser drip legs, and heat tracer lines.

3.06 PIPING INSTALLATIONS

A. Refer to Division 23 Section "Basic Materials and Methods" for basic piping installation requirements.
B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

1. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

C. Install steam supply piping at a uniform grade of 0.2 percent downward in direction of steam flow.

D. Install condensate return piping at a uniform grade of 0.4 percent downward in direction of condensate flow.

1. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

2. Unless otherwise indicated, install branch connections to steam mains using 45-degree fittings in main pipe, with the takeoff coming out the top of the main pipe. Use of 90-degree tee fittings is permissible if 45-degree fittings are impractical. If length of branch takeoff is less than 10 feet (3 m), pitch branch line down toward mains at a 0.4 percent grade.

3. Install unions in piping NPS 2 (DN 50) and smaller adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated.

4. Install flanges in piping NPS 2-1/2 (DN 65) and larger at final connections of each piece of equipment and elsewhere as indicated.

5. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, traps, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

6. Anchor piping for proper direction of expansion and contraction.

7. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.

8. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet (90 m) where pipe is pitched down in direction of steam flow and a maximum of 150 feet (45 m) where pipe is pitched up in direction of steam flow.

9. Size drip legs at vertical risers same size as pipe and extend beyond rise. Size drip legs at other locations same diameter as main. In steam mains NPS 6 (DN 150) and larger, dirt leg size can be reduced, but to no less than NPS 4 (DN 100).

10. Install gate valve at drip legs, dirt pockets, and strainer blowdowns to allow removal of dirt and scale.

11. Install steam traps close to drip legs.

12. Pitch condensate piping down toward flash tank. If more than one condensate pipe discharges into flash tank, install a swing check valve in each line. Install thermostatic air vent at top of tank. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the condensate load. Install safety valve at tank top. Install pressure gage, gate valve, and swing check valve on low-pressure (flash) steam outlet.

3.07 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment, but not more than 48 inches (1200 mm) from connected equipment.

B. Unless otherwise indicated, install gate valve, strainer, and union upstream from trap; install union, check valve, and gate valve downstream from trap.

3.08 PRESSURE-REDUCING VALVE INSTALLATION

A. Install pressure-reducing valves in readily accessible location for maintenance and inspection.

B. Install bypass piping around each pressure-reducing valve, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.

C. Install gate valves around each pressure-reducing valve.

D. Install unions around each pressure-reducing valve having threaded-end connections.

E. Install pressure gages on low-pressure side of each pressure-reducing valve and ahead of shutoff valve. Install pressure gages downstream from globe valve on pressure-reducing valve bypass.

F. On two-stage pressure-reducing stations, install drip trap and pressure gage upstream from second stage pressure-reducing valve.

G. Install strainers upstream for each pressure-reducing valve.

H. Install safety valves downstream from each pressure-reducing valve station.

3.09 STEAM METER INSTALLATION

A. Install lengths of straight pipe upstream and downstream from meters according to steam meter manufacturer's instructions.

3.10 SAFETY VALVE INSTALLATIONS

A. Install safety valves according to ASME B31.1. Pipe safety valve discharge without valves to atmosphere outside building. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

3.11 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.

2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.

C. Install hangers with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 9 feet (2.7 m); minimum rod size, 1/4 inch (6.4 mm).

2. NPS 1 (DN 25): Maximum span, 9 feet (2.7 m); minimum rod size, 1/4 inch (6.4 mm).

3. NPS 1-1/2 (DN 40): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).

4. NPS 2 (DN 50): Maximum span, 12 feet (4 m); minimum rod size, 3/8 inch (10 mm).

5. NPS 2-1/2 (DN 65): Maximum span, 12 feet (4.3 m); minimum rod size, 3/8 inch (10 mm).

6. NPS 3 (DN 80): Maximum span, 12 feet (4.6 m); minimum rod size, 3/8 inch (10 mm).

7. NPS 4 (DN 100): Maximum span, 12 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).

8. NPS 6 (DN 150): Maximum span, 12 feet (6.4 m); minimum rod size, 1/2 inch (13 mm).

9. NPS 8 (DN 200): Maximum span, 12 feet (7.3 m); minimum rod size, 5/8 inch (16 mm).

10. NPS 10 (DN 250): Maximum span, 12 feet (8 m); minimum rod size, 3/4 inch (19 mm).

11. NPS 12 (DN 300): Maximum span, 12 feet (9.1 m); minimum rod size, 7/8 inch (22 mm).

12. NPS 14 (DN 350): Maximum span, 12 feet (9.8 m); minimum rod size, 1 inch (25 mm).

13. NPS 16 (DN 400): Maximum span, 12 feet (10.7 m); minimum rod size, 1 inch (25 mm).

14. NPS 18 (DN 450): Maximum span, 12 feet (11.3 m); minimum rod size, 1-1/4 inches (32 mm).
15. NPS 20 (DN 500): Maximum span, 12 feet (11.9 m); minimum rod size, 1-1/4 inches (32 mm).

D. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

3.12 PIPE JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Materials and Methods" for joint construction requirements for threaded, welded, and flanged joints.

3.13 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install vacuum breaker downstream from control valve and bypass and close to coil inlet connection.

E. Install ports for pressure and temperature gages at coil inlet connections.

F. Install a drip leg at coil outlet.

3.14 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Flush system with clean water. Clean strainers.

3. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

4. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on steam and condensate piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. While filling system, use vents installed at high points of system to release trapped air. Use drip legs installed at low points for complete draining of liquid.

3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."

4. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

5. Prepare written report of testing.

3.15 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after steam and condensate system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Set temperature controls so all coils are calling for full flow.
3. Check operation of automatic bypass valves.

3.16 CLEANING

A. Flush steam and condensate piping with clean water. Remove and clean or replace strainer screens.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 232300 – REFRIGERATION PIPING SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of refrigeration piping systems work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for refrigeration piping systems include the following:

1. Refrigerant suction line piping between compressors and cooling coils.
2. Refrigerant liquid line piping between liquid receivers and cooling coils.
3. Refrigerant discharge line piping between compressors and condensers.
4. Refrigerant condenser drain line piping between condensers and liquid receivers.

C. Insulation for refrigeration piping is specified in applicable Division 23 sections, and is included as work of this section.

D. Refer to appropriate Division 23 sections for insulation required in connection with refrigeration piping, not work of this section.

1.03 QUALITY ASSURANCE

A. Materials and equipment shall be provided by one of the manufacturers listed in Part 2 - Products. Materials and equipment from other manufacturers may be accepted if proven equal to those specified. This contractor is liable for and shall pay for all architectural and engineering review and redesign costs for substitute materials and equipment. This contractor also is liable for all costs of changes in the work required by substitute equipment.

B. The length of time the manufacturer has been in business, the location and capability of complete repair facilities, availability of repair parts and annual maintenance contracts all will be considered in determining equality.

C. Refer to General Conditions Section GC31, "Submissions", for requirements pertaining to substitute materials and equipment.

D. Installer - a firm with at least 3 years of successful installation experience on projects with refrigeration piping system work similar to that required for project.

E. ANSI code compliance - comply with applicable provisions of ANSI B31.5, "Refrigeration Piping" and extend applicable lower pressure limits to pressures below 15 psig.

F. Safety code compliance - comply with applicable portions of ANSI/ASHRAE 15, "Safety Code for Mechanical Refrigeration".

G. Brazing - comply with applicable requirements of ANSI/ASME B31.5, "Refrigeration Piping", pertaining to brazing of refrigeration piping for shop and project site locations.

1.04 SUBMITTALS

A. Product data - submit manufacturer's data for refrigeration piping systems materials and products.

B. Brazing certification - certify brazing procedures, brazers and operators in accordance with ANSI/ASME B31.5.

C. Shop drawings - submit scaled layout drawings of installed refrigeration pipe and fittings including, but not necessarily limited to, pipe sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS

2.01 REFRIGERATION PIPING MATERIALS AND PRODUCTS

A. General - provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by engineer and manufacturer of equipment to comply with installation requirements. Provide materials and products complying with ANSI/ASME B31.5 Code for Refrigeration Piping where applicable, base pressure rating of refrigeration piping system maximum design pressures. Provide sizes and types matching piping and equipment connections, provide fittings of materials which match pipe materials used in refrigeration piping systems. Where more than one type of materials or products are indicated, selection is engineers' option.

2.02 BASIC IDENTIFICATION

A. General - provide identification complying with Division 23 Basic Materials and Methods section in accordance with the following listing:

1. Refrigeration piping - plastic pipe markers.

2.03 BASIC PIPE, TUBE AND FITTINGS

A. General - provide pipe, tube and fittings complying with Division 23 Basic Materials and Methods section "Pipe, Tube and Fittings", in accordance with the following listing:

1. Pipe size 2" and smaller - black steel pipe.

    a. Pipe weight - Schedule 40.
    b. Pipe weight - Schedule 80.
    c. Fittings - forged steel, socket welding.
    d. Fittings - wrought steel, buttwelding.

2. Pipe size 2 1/2" and larger - black steel pipe.

    a. Pipe weight - Schedule 40
    b. Pipe weight - Schedule 80.
    c. Fittings - wrought steel, buttwelding.

3. Tube size 3" and smaller - copper tube.

    a. Wall thickness - Type K, hard drawn temper.
    b. Wall thickness - Type L, hard drawn temper.
    c. Fittings - wrought copper, solder joints.

d. Joints - soldered, silver lead solder, ANSI/ASTM B 32, Grade 96 TS.
e. Joints - brazed, American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

4. Tube size 4 1/8" and smaller - copper tube.

a. Wall thickness - type ACR, hard drawn temper.
b. Fittings - wrought copper, solder joints.
c. Joints - soldered, silver lead solder, ANSI/ASTM B 32, Grade 96 TS.
d. Joints - brazed, American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

5. Tube size 3/4" and smaller - copper tube.

a. Wall thickness - type ACR, soft annealed temper.
b. Fittings - cast copper alloy for flared copper tubes.
c. Joints - flared.

6. Tube size 7/8" through 4 1/8" - copper tube.

a. Wall thickness - type ACR, soft annealed temper.
b. Fittings - wrought copper, solder joints.
c. Joints - soldered, silver solder, ANSI/ASTM B 32, Grade 96 TS.
d. Joints - brazed, American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

2.04 BASIC PIPING SPECIALTIES

A. General - provide piping specialties complying with Division 23 Basic Materials and Methods section "Piping Specialties", in accordance with the following listing:

1. Pipe escutcheons.
2. Pipe sleeves.

2.05 BASIC SUPPORTS, ANCHORS AND SEALS

A. General - provide supports, anchors and seals complying with Division 23 Basic Materials and Methods section "Supports, Anchors and Seals", in accordance with the following listing:

1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
2. Two bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.
4. Protection shields for insulated piping support in hangers.
5. Copper flashings for piping penetrations.

2.06 SPECIAL REFRIGERATION VALVES

A. General - special valves required for refrigeration piping systems include the following types:

1. Globe and check valves:

a. Globe shutoff valves - forged brass, packed, back seating, winged seal cap, 300 degrees F (149 C) temperature rating, 500 psi working pressure.

b. Check valves - forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250 degrees F (121 C) temperature rating, 500 psi working pressure.

c. Available manufacturers - subject to compliance with requirements, manufacturers offering globe and check valves which may be incorporated in the work include, but are not limited to, the following:

d. Manufacturer - one of the following:

1) Henry Valve Co.
2) Parker Hannifin Corp, Refrigeration & Air Conditioning Div.
3) Sporlan Valve Co.

2. Solenoid valves:

a. 2-way solenoid valves - forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL listed, 1/2" conduit adapter, 250 degrees F (121 C) temperature rating, 400 psi working pressure.

1) Manual operator - provide manual operator to open valve.

b. Available manufacturers - subject to compliance with requirements, manufacturers offering solenoid valves which may be incorporated in the work include, but are not limited to, the following:

c. Manufacturer - one of the following:

1) Alco Controls Div. Emerson Electric Co.
2) Automatic Switch Co.
3) Sporland Valve Co.

2.07 REFRIGERATION ACCESSORIES

A. Refrigerant strainers - brass shell and end connections, brazed joints, monel screen, 100 mesh, UL listed, 350 psi working pressure.

B. Moisture liquid indicators - forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200 degrees F (93 C) temperature rating, 500 psi working pressure.

C. Refrigerant filter driers - steel shell, ceramic fired desiccant core, solder connections, UL listed, 500 psi working pressure.

D. Refrigerant filter driers - corrosion resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter drier core, 500 psi working pressure.

E. Evaporator pressure regulators - provide corrosion resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.

F. Refrigerant discharge line mufflers - provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL listed.

G. Available manufacturers - subject to compliance with requirements, manufacturers offering refrigeration accessories which may be incorporated in the work include, but are not limited to, the following:

H. Manufacturer - one of the following:

1. Alco Controls Div. Emerson Electric Co.
2. Henry Valve Co.
3. Sporlan Valve Co.

PART 3 - EXECUTION

3.01 INSTALLATION OF BASIC IDENTIFICATION

A. General -install mechanical identification in accordance with Division 23 Basic Materials and Methods section "Mechanical Identification"

3.02 INSTALLATION OF REFRIGERATION PIPING

A. General - install refrigeration piping in accordance with Division 23 Basic Materials and Methods section "Pipe, Tube and Fittings", and in compliance with equipment manufacturer's recommendations.

3.03 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with requirements of Division 23 Basic Materials and Methods section "Piping Specialties".

3.04 INSTALLATION OF SUPPORTS, ANCHORS AND SEALS

A. Install supports, anchors, and seals in accordance with requirements of Division 23 Basic Materials and Methods section "Supports, Anchors and Seals".

3.05 INSTALLATION OF SPECIAL REFRIGERATION VALVES

A. General - install refrigeration valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing, replace after joints are completed.

1. Solenoid valves - install in refrigerant piping as indicated with stem pointing upwards.

a. Wiring of solenoid valves is specified in applicable Division 26 sections and is included as work of this section.
b. Wiring of solenoid valves is specified in applicable Division 26 sections, not work of this section.

3.06 INSTALLATION OF REFRIGERATION ACCESSORIES

A. Refrigerant strainers - install in refrigerant lines as indicated and in accessible location for service.

B. Moisture liquid indicators - install as indicated on refrigerant liquid lines, in accessible location.

C. Refrigerant filter dryers - install in refrigerant lines as indicated, and in accessible location for service.

D. Evaporator pressure regulators - install in refrigerant suction lines or evaporator outlets as indicated. Adjust, if required, for proper evaporator pressure.

E. Refrigerant discharge line mufflers - install as indicated, in horizontal or downflow portion of hot-gas lines, immediately after leaving compressor, not in riser.

3.07 EQUIPMENT CONNECTIONS

A. General - connect refrigerant piping to mechanical equipment in manner shown, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.08 FIELD QUALITY CONTROL

A. Refrigerant piping leak test - prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum and then 200 psi using halide torch. System must be entirely leak free.

B. Repair or replace refrigerant piping as required to eliminate leaks and retest as specified to demonstrate compliance.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233000 – AIR DISTRIBUTION

PART 1 – GENERAL

1.01 GENERAL

A. Construct all apparatus of materials suitable for the conditions encountered during operation.

B. Where corrosion can occur, appropriate corrosion-resistant materials and assembly methods must be used including isolation of dissimilar metals against galvanic interaction.

C. All factory applied acoustical and thermal insulation, including facing and adhesives, it to be fire-resistant and to conform to requirements of NBFU and State Codes.

D. Where in contact with the air stream, protect insulation against erosion or flaking by a factory applied plastic or mat facing.

E. Locate and arrange motors, eliminators, filters, cooling and heating coils, and other components and accessories so that they are accessible for repair, maintenance, and replacement.

F. Mount grease fitting directly on bearings unless the latter are not readily accessible. Where equipment bearings are not visible or are inaccessible, provide easily accessible extensions to bearing lubrication fittings.

G. Thoroughly clean the entire system before installing filters or operating the fans.

H. On systems containing filters, install filters and permanently seal the filter frames airtight before operating the fans. The Contractor, at his own expense, shall replace all dirty filters before turning over the system to the Owner, and furnish the Owner with one complete set of replacement filters for all banks. Seal all outlets around the edges to prevent air leakage.

I. Bracing and supports indicated are the minimum acceptable. Install additional bracing or supports to eliminate any distortion or vibration when the systems are operating or under tests.

J. Install ducts, castings, and hangers plumb and level, with joints square and devoid of sharp edges.

K. Unless otherwise specified, construct all duct work, including angles, bars, and other bracings, hangers, supports, and accessories of galvanized steel, all in accordance with schedules in the latest ASHRAE Guide.

L. Diffusers, grilles, registers, and transfers shall be sized and located as shown on the drawings.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233101 – DUCT CLEANING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Removal and disposal of visible dirt, debris, and other contaminants.

2. Cleaning and decontamination of all supply, return and exhaust ductwork, diffusers, grilles and registers.

3. Chemical pressure washing and decontamination of all heating and cooling coils.

4. Cleaning and decontamination of dampers, supply air fans, exhaust air fans and other components of the HVAC systems.

5. Removal, disinfection, and/or sealing the supply duct lining with an anti-fungicidal coating as specified in the project drawings.

6. Verification and updating of working drawings.

1.02 SUBMITTALS

A. Product data for each product specified in this section.

B. Material safety data sheets for all products used.

C. Project Record Documents:

1. Upon completion of the project, submit one set of red-marked, duct layout drawings showing the location of all new access holes and openings installed in the duct systems to accommodate the cleaning process.

D. Qualifications, schedules and reports:

1. Qualification and experience documentation

2. Project schedule and procedures

3. Final report (3 copies)

E. Product-Data:

1. Submit manufacturer's data sheets, including Material Safety Data Sheets (MSDS) if applicable, for the following:

a. Air-tight plastic closure plugs
b. Vacuum cleaning machines and/or cleaning related equipment and accessories
c. Biocide sanitizing fluid
d. Anti-fungicidal duct work sealant
e. Others as applicable

1.03 QUALITY ASSURANCE

A. All work in this section shall be performed by an independent specialty HVAC duct cleaning contractor. The contractor shall be certified by NADCA (National Air Duct Cleaners Association). Submit information indicating qualifications and experience.

B. Conform to NFPA 90A

C. Conform to the requirements of the following standards that do not conflict with regulatory requirements or requirements of the contract documents:

1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

2. NADCA "General Specifications for the Cleaning of Commercial Heating and Ventilation Systems."

D. Factory-Made Products - Listed by Underwriters Laboratories, Inc. (UL)

E. Video/photographic documentation before and after the cleaning process.

F. EPA registration for fungicide coating.

G. A project closing report shall be submitted upon completion of the entire cleaning project. Report shall include a dated summary of the duct systems and HVAC unit inspections and approvals by the Owner's designated representative. Project closing report shall be bound, neatly presented and organized according to HVAC unit, duct system or fan. Also include photographic documentation (min. 3" x 5" color prints) of before and after conditions of each system component or section.

1.04 FIELD MEASUREMENTS

A. Field measure related work to ensure proper fit and clearance.

B. Field measure existing work to ensure proper fit and clearance.

PART 2 – PRODUCTS

2.01 DUCT ACCESS PATCHES

A. Premanufactured sheet metal patches that are crossbroke, hemmed and predrilled, with insulation to match ductwork.

2.02 DUCT ACCESS DOOR

A. Premanufactured access door with locking seal.

2.03 DUCT SEALER

A. Product specifically rated for sealing duct work meeting NFPA requirements.

B. Seal modifications to existing ductwork in accordance with duct sealing described in SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

2.04 HVAC DISINFECTANT/CLEANER

A. EPA registered formula for disinfection and cleaning of HVAC equipment equal to Foster Products 40-80.

B. Stabilized chlorine dioxide - Oxine or approved equivalent.

2.05 FUNGICIDAL PROTECTIVE COATING

A. EPA registered polyacrylate emulsion specifically formulated for long term fungicidal activity and HVAC application. Equal to Foster Products 40-20.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine elements and surface intended to support products.

B. Verify that each product conforms to regulatory requirements and to specification requirements.

C. Correct any unsatisfactory conditions before installing products of this section.

3.02 EQUIPMENT

A. HEPA filtered vacuum collector system capable of maintaining up to 1.0 inches of static pressure inside the isolated area of ductwork.

B. HEPA filtered wet/dry vacuums.

C. Air compressor as required.

1. The specific air or water pressure selected by the Contractor for air or water washing of various HVAC system components shall be appropriate to the item and component being washed. Water pressure utilized shall not exceed 1,000 psig.

2. Contractor shall repair or replace any system component damaged as a result of using excessive air or water pressure.

D. Rotary brush system for mechanical cleaning of ductwork.

3.03 PREPARATION

A. The location of each access hole or opening shall be shown and identified in a red- marked blue-lined print set of the duct system layout drawings.

B. Seal off ends and openings of any ductwork not being immediately worked on.

C. Isolate duct section to be worked upon, by using Protective seal barriers within the ductwork, to prevent loose dirt and debris from migrating to cleaned sections of the duct system.

D. Protect surrounding elements from damage and disfigurement resulting from work of this section.

E. Synthetic filter media (one inch thick 30% efficiency), or approved other, shall be temporarily fitted over each register, grille and diffuser in the duct system to intercept any migrating loose dirt and debris.

F. Each work area shall: be protected from being soiled with polyethylene plastic sheet. A protective sheet shall cover all furniture in each room of the work area. Furniture, in the case of laboratory rooms, shall, include all laboratory benches, fume hoods, desks, and related laboratory equipment. Upon completion of the duct system cleaning in each work area, protective sheeting shall be carefully removed with collected dirt and debris disposed of in an approved manner. Vacuum clean floors and other areas in each room restoring each room to its original clean condition.

G. Suitably support and brace any ductwork which will be entered by personnel.

3.04 SEQUENCE OF CLEANING AND DECONTAMINATING DUCTS

A. All work shall be conducted during unoccupied times and shall be coordinated with the designated owners' representative.

B. Take the fans off energy scheduling and allow them to run 24 hours except when the ductwork is being cleaned.

C. Clean the outside air intake grille and shaft.

D. Clean the return air ducts starting at the outer ends of the return air system and concluding at the mixed air chamber and the exhaust stack.

E. Clean the interior of the air handling unit. Remove and replace interior insulation at this time. Coordinate this work with mechanical drawings. Insulation replacement will not be required for new equipment.

F. Install products in compliance with manufacturer's instructions.

G. Pre-vacuum diffusers, grills and registers in the ductwork that are to remain. If necessary, remove, chemically wash/clean and reset (not required for existing diffusers to be replaced).

H. Existing ductwork and insulation shall be neatly cut as required to provide access to facilitate cleaning of the ductwork and components. As necessary, protect downstream areas from receiving particulates during the installation of access points.

I. Install vacuum collector unit at a predetermined location and clean the section of ductwork using omindirectional air nozzles and rotary brushes as necessary. Large crawlable ducts may be hand vacuumed or brushed and air washed.

J. Clean the supply ductwork starting from the supply fan and ending at the supply diffuser. At no point should uncleaned ductwork be upstream from clean ductwork.

K. Location of access holes and openings shall be approved by the Owner's designated representative.

L. Existing duct access panels shall be used wherever possible.

M. Upon completion of the cleaning operation, the round access openings shall be plugged air-tight with plastic caps designed for this purpose.

N. The rectangular access openings shall be closed using an overlapping galvanized sheet metal, or material to match existing ductwork, cover (cross broken) of the same gauge thickness as existing duct. Rectangular cover shall be fastened using self-tapping sheet metal screws with a silicone bead sealing gasket; or 3M No. 1202-T sealant tape used as a sealing gasket, at perimeter of cover. Seal all joints air-tight.

O. Where ducts are provided with exterior insulation, neatly cut and remove insulation as required to accommodate required duct access holes and openings. When complete, reinsulate at ducts at access points and install new vapor barriers to match existing.

P. Visually inspect the duct interior prior to cleaning each duct section. Use a fiber-optic borescope to accomplish the inspection task for all smaller ducts not otherwise accessible.

Q. Wash and vacuum clean each duct section:

Lined Ducts: Air pressure wash and vacuum or rotary brush and vacuum. The cleaning process shall not degrade the fiberglass insulation. Damaged insulation will be replaced or repaired at the discretion of the owners Representative.

1. Fog the interior of the ductwork with Oxine and allow to dry.

2. Upon completion of the cleaning of each fiberglass lined duct section, seal the surface of the fiberglass lined duct with Foster 40/20 or an approved white encapsulant equivalent.

Unlined Ducts: Air pressure wash and vacuum or rotary brush and vacuum. Hand wipe or hand vacuum if space allows. Fog the interior of the ductwork with Oxine and allow to dry.

R. Visually inspect each duct section using a borescope where necessary, to ensure the duct section is clean.

S. All registers, grilles and diffusers shall be removed, vacuum cleaned, washed and then reinstalled.

T. After duct section and reheat coils have been completely cleaned and sanitized, a final visual inspection, using a fiber-optic borescope as required, shall be accomplished with the Owner's designated representative for conditional approval. At this time, an owners' representative will take samples for mold contamination. The cleaning will receive final approval if the total fungal counts on a surface Rodac plate sample taken from the surface of the duct do not exceed 50 colony forming units on any plate. Verbal confirmation of the clearance surface sampling results will be given seven days after the final surface sample results are taken. If the desired cleaning effectiveness is not achieved, the area will have to be re-cleaned by the Contractor. The results of the cleaning effectiveness will be included in the final report. The cleaning contractor shall provide all ladders, lighting, fiber-optic borescope, and other miscellaneous equipment required to permit the owner's representative to inspect all portions of the project.

U. Repeat the cleaning process described above for succeeding duct sections until entire duct system is completely clean.

V. Reinsulate the exterior of the supply duct work if the interior insulation has been removed. Design sound attenuation modification if needed.

W. Verify that the building's air supply and return system is properly balanced.

X. Duct Access Doors:

1. A certified sheetmetal worker shall install all duct access doors.

2. Install duct access doors on the side of duct where adequate clearance is available.

3. Install duct access doors at other locations requiring access to duct interior for inspection, cleaning, adjusting, maintenance and operation.

4. Size: 18 inches by 16 inches unless duct is too small for this size.

Y. Install duct test holes as required.

3.05 CLEANING HVAC EQUIPMENT

A. Isolate HVAC unit housing from adjacent equipment and building room surfaces with polyethylene sheet.

B. Protect all motors, bearing assemblies, and belt drive assemblies within the HVAC unit housing with taped-on polyethylene sheet to prevent intrusion of potentially damaging wash water.

C. Carefully remove filters/filter media from holding frames and/or spools in an approved manner and store filters and protect from damage. Reinstall filter media after cleaning operation is complete, in accordance with filter manufacturer's instructions to insure a leak-free installation. Do not restart fans until all filters have been reinstalled and inspected by owner representative.

D. Insulation on the interior of the supply fan shall be removed and replaced with exterior insulation. Alternatively, IMCOA closed cell foam insulation or its approved equal may be applied to the interior of the supply fan.

E. Vacuum clean entire internal space of HVAC unit, including each component including component supports, frames, mounts, etc. contained therein, to remove loose dirt and debris.

F. Pressure wash, using an EPA approved cleansing agent, each HVAC unit. This shall include all the internal surfaces of the HVAC unit housing and all the internal components of the HVAC unit including fans, cooling and heating coil banks, filter bank support frames, and contiguous control damper assemblies.

G. Pressure washing of the heating and cooling coil banks shall be accomplished at both the upstream and downstream faces of the coils.

H. Where deemed necessary by the Cleaning Contractor, cleansing agent solution may be separately supplied prior to pressure wash.

I. Hand scrub where required to remove all residual dirt.

J. Rinse thoroughly with clear water to remove any residual dirt and cleansing agent.

K. Fan casings and impeller wheels shall be cleaned on all surfaces, inside and outside.

L. Vacuum clean all pressure washed surfaces. Vacuum collected wash water shall be disposed of outside of the HVAC unit.

M. A visual inspection of the HVAC unit, including all of its internal components shall be performed by the Owner's designated representative together with the Cleaning Contractor. At this time, an owner designated representative will take samples for mold contamination. The cleaning will receive final approval if the total fungal counts on a surface Rodac plate sample does not exceed 50 colony forming units on any plate. If the desired cleaning efficiency is not achieved, the area will have to be re-cleaned by the Contractor. Include this data in the final report.

3.06 APPLICATION OF FUNGICIDAL PROTECTIVE COATING

A. Apply fungicidal protective coating as per manufacturer's instructions with the HVAC system on interior fiberglass insulation that was previously cleaned and disinfected.

B. Do not coat coils, filters, controls or fans.

C. If the interior of a VAV box is encapsulated, the controls on the box must be protected from the encapsulant. The performance of the box must not be compromised by the duct cleaning.

3.07 FIELD QUALITY CONTROL

A. Inspect installed products to observe damage.

B. Test and demonstrate as required by the governing authority.

C. Do not allow discharge air from the fungicidal coating process to enter occupied spaces.

D. Ceiling and wall surfaces that are damaged by this work shall be replaced or repaired as required.

E. Testing, Adjusting and Balancing.

1. Secure all manual dampers at full open position.

2. Set splitters straight with the main duct.

3. Complete and clean the duct systems to prepare for testing, adjusting and balancing work.

F. FINAL PURGE

1. Work Area Preparation

a. Cover all terminal air outlets (diffusers, registers, grilles, etc.) with synthetic filter media at least 30% efficient. Tape filter to terminal device frame to eliminate air leakage.

2. Purge Procedure

a. Inform Owner's designated representative that outlets have been covered with synthetic filter media at least 30% efficient.
b. Insure all filters have been properly installed.

3. After receiving verbal confirmation about attainment of proper cleaning efficiency from an owner representative start HVAC units and in the event of variable speed/volume systems operate unit up and down between low and high speed to dislodge dirt and debris. Perform purge operation continuously for minimum of 1 hour.

4. Clean-Up:

a. Remove synthetic filter media from air terminal outlets, and wash and dry outlet frame with approved cleaning solution.
b. Vacuum and clean work areas to original condition.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233113 – DUCTWORK

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of ductwork is indicated on drawings and by requirements of this section.

B. Types of ductwork required for project include the following:

1. Heating supply and return air systems.
2. Air conditioning supply and return air systems.
3. Fresh air supply systems.
4. Mechanical exhaust systems.
5. Air relief systems.
6. Fume hood exhaust systems.
7. Wood shop exhaust system.

C. Specific Duct System Classifications:

Service	Material	Pressure Class	Velocity
HVAC Supply	Galvanized Steel	2" WG	2500 FPM
Return Relief Exhaust	Galvanized Steel	1" WG Negative	1500 FPM
Air Plenums	Galvanized Steel	2" WG	2500 FPM
Fume hood	Stainless Steel	4" WG Negative	4000 FPM
Woodshop	Galvanized Steel	5" WG Negative	3000 FPM

D. External insulation for ductwork is specified in Division 23 insulation sections, and is not included as work of this section.

E. Duct accessories are specified in Division 23 Section and are included as work of this section.

F. Inlets and outlets are specified in Division 23 section and are included as work of this section.

G. Duct lining, as specified herein and indicated on drawings, is included as work of this section.

1.02 SUBMITTALS

A. Product data: Submit manufacturer's specifications on manufactured products and factory fabricated ductwork, used for work of this section.

B. Shop drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure. Duct dimensions shall be external and provide adequate space to include lining and maintain internal dimensions indicated on contract drawings. When appropriate, show modifications of indicated requirements made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

C. As-Built drawings: At project closeout, submit as-built drawings of installed ductwork, duct accessories, and outlets and inlets, in accordance with requirements of Division 01.

1.03 QUALITY ASSURANCE AND REQUIRED CODES AND STANDARDS

A. SMACNA standards (metal and flexible ductwork) - comply with SMACNA "HVAC Duct Construction Standards" latest edition for fabrication and installation of metal and flexible ductwork.

B. SMACNA standards (thermoplastic duct) - comply with SMACNA "Thermoplastic Duct (PVC) Construction Manual" latest edition for fabrication and installation of thermoplastic (PVC) ductwork.

C. SMACNA standards (fibrous glass ductwork) - comply with SMACNA "Fibrous Glass Duct Construction Standards" latest edition for fabrication and installation of fibrous glass ductwork.

D. SMACNA standards (industrial duct) - comply with SMACNA "Accepted Industry Practice for Industrial Duct Construction"; "Accepted Industry Practice for Round Industrial Duct Construction"; and "Accepted Industry Practice for Square Industrial Duct Construction", latest editions, for fabrication and installation of industrial ductwork.

E. SMACNA standards: Comply with SMACNA "Duct Liner Standards" for installations of duct liner in sheet metal ductwork.

F. NYS compliance: Comply with NFPA 90 A "Standard for the Installation of Air Conditioning and Ventilating Systems."

G. Mechanical Code of New York State

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

A. Exposed ductwork materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating, mill phosphatized for exposed locations.

C. Flexible Duct - Polyethylene Vapor Barrier Type. Where indicated, provide insulated flexible duct as follows:

1. Galvanized steel helix, formed and mechanically locked to fabric.
2. Aluminum foil trilaminate, fiberglass and aluminized polyester, mechanically locked (no adhesive).
3. Exterior fiberglass insulation blanket factory wrapped. Thermal conductance, C factor, not more than 0.23.
4. Outer jacket of gray fire retardant polyethylene material.

5. UL listed per UL 181, Class 1 Air Duct.
6. Operating temperature range -20 degrees to 250 degrees F.
7. Flame spread less than 25, smoke developed less than 50.
8. Working pressures:

    a. 6 inch w.g. positive (all diameters).
    b. 4 inch w.g. negative, through 16 inch diameters.
    c. 1 inch w.g. negative, 18 to 20 inch diameters.

9. Rated velocity: 4,000 FPM.
10. Manufacturer:

    a. Flexmaster, Type 3.
    b. Clevaflex USA, Inc.
    c. Thermaflex.

D. Flexible Duct Fittings: Provide factory manufactured galvanized steel fittings. Use 45 degree laterals, ball mouth tees, spin collars, or conical tees for duct taps. 90 degree tees shall not be allowed.

2.02 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

    a. CertainTeed Corp.; Insulation Group.
    b. Johns Manville International, Inc.
    c. Knauf Fiber Glass GmbH.
    d. Owens Corning.

B. Materials: ASTM C 1071; surfaces exposed to air stream shall be coated to prevent erosion of glass fibers.

    a. Thickness: 2 inches.
    b. Thermal Conductivity (k-Value): 0.26 at 75°F (0.037 at 24°C) mean temperature.
    c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
    d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

        1) Tensile Strength: Indefinitely sustain a 50-lb- (23-kg) tensile, dead-load test perpendicular to duct wall.
        2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch (3 mm) into air stream.
        3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.03 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct sealant: Non-hardening, non-migrating mastic elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Liquid allowed for slip joints only. Silicone base duct sealer shall be used on duct joints exposed to weather.

C. Ductwork support materials.

1. For galvanized steel ductwork, provide hot dipped galvanized steel fasteners, anchors, rods, straps, trim and angles.
2. For stainless steel ductwork, provide matching stainless steel support materials.
3. For flexible ductwork, provide hot dipped galvanized steel support material.

D. Duct Connector: Where duct system meets or exceeds pressure class of 2" w.g., positive or negative, incorporate the use of rolled, formed, machine manufactured duct connector.

1. Manufacturer: Subject to compliance with requirements, provide duct connector of one of the following:

2. Ward.
3. Ductmate.
4. United McGill.
5. Flexmaster.

2.04 SHOP FABRICATION

A. Shop fabricate ductwork in 4, 8, 10 or 12 foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for re-assembly and coordinated installation.

B. Shop fabricate ductwork of gages and reinforcement complying with applicable SMACNA standard.
C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with inside radius equal to associated duct width. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 section "Duct Accessories" for accessory requirements.

E. Fabricate ductwork with duct liner in each section of duct where indicated. Fabricate ductwork large enough to accept liner of thickness indicated and to maintain inside dimensions shown on contract drawings. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

F. Provide lining in all ductwork that is conveying below ambient temperature air and is not insulated. Provide lining in supply air and return air ductwork from air handling unit to 20 feet away from the unit. Provide lining in ductwork as indicated on drawings.

2.05 FACTORY FABRICATED DUCTWORK

A. General: At Installer's option, provide factory fabricated spiral, round or oval duct and fittings, in lieu of shop fabricated duct and fittings.

B. Gauge: Tables 3-2 and 3-3 SMACNA "HVAC Duct Construction Standards." No standing rib shall be allowed.

C. Oval Elbows: 3 gore 90 degree and 2 gore 45 degree with machine formed seam.

D. Round Elbows: one piece construction for 90 degree and 45 degree elbows 14" and smaller. Provide 5 gore 90 degree and 3 gore 45 degree construction for larger diameter with machine formed seam joint.

E. Divided flow fittings: 90 degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

F. Manufacturer: subject to compliance with requirement, provide factory fabricated ductwork of one of the following:

1. United Sheet Metal Div., United McGill Corp.
2. Semco

PART 3 - EXECUTION

3.01 INSTALLATION OF DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

B. Duct Sizing: Duct sizes indicated on drawings are inside dimensions.

C. Flexible Duct: Flexible duct may be used for connecting room diffuser to sheet metal duct and/or ceiling terminal box only. Extend flexible duct completely and limit lengths to five feet (5'), or as indicated on Drawings. Support according to SMACNA.

D. Seal ductwork to seal class as prescribed in SMACNA "HVAC Duct Construction Standards" for the static pressure classes indicated, unless otherwise recommended.

E. Complete fabrication of work at project as necessary to match shop fabricated work and accommodate installation requirements.

F. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

G. Electrical equipment spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.

H. Boiler Rooms: Do not run ductwork through boiler rooms unless protected per NFPA requirements.

I. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus insulation with sheet metal flanges of same gage as duct. Overlap opening on four sides by at least 1-1/2".

J. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

K. Support ductwork in manner complying with appropriate SMACNA standard.

3.02 INSTALLATION OF WOODSHOP EXHAUST (N/A)

3.03 APPLICATION OF LINER IN RECTANGULAR DUCTSS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

G. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosing's that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used; secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.04 CLEANING AND PROTECTION

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary closure - at ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

3.05 BALANCING

A. Refer to Division 23 Section 230593 "Testing, Adjusting and Balancing" for air distribution balancing of ductwork. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233300 – DUCT ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of duct accessories work is indicated on drawings and in schedules, and by requirements of this section.

B. Types of duct accessories required for project include the following:

1. Fire and smoke dampers(in compliance with NFPA80-STD for opening protectives)
2. Access doors
3. Turning vanes
4. Manual Dampers
    a. Butterfly manual dampers
    b. Opposed-blade manual dampers
5. Intake/Exhaust dampers
6. Flexible connections

1.02 SUBMITTALS

A. Product data - submit manufacturer's specifications for each type of duct accessory, including dimensions, capacities, and materials of construction, and installation instructions.

B. Shop drawings - submit assembly type shop drawings for each type of duct accessory showing interfacing requirements with ductwork, and method of fastening or support.

C. Maintenance data - submit manufacturer's maintenance data including parts lists for each type of duct accessory, include this data in Maintenance Manual.

1.03 QUALITY ASSURANCE

A. SMACNA compliance - comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) high pressure and low pressure duct construction standards.

B. Industry standards - comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to construction of duct accessories, except as otherwise indicated.

C. UL compliance - construct, test and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".

D. NFPA compliance - comply with applicable provisions of ANSI/NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of duct accessories.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver components with factory installed packing and protective containers.

B. Handle components carefully to prevent damage to components and finish. Do not install damaged components; replace with new.

C. Protect components from weather, dirt, construction traffic and debris, etc.

PART 2 - PRODUCTS

2.01 FIRE AND SMOKE DAMPERS

A. Standards, Fire and Smoke Dampers: Conform to the requirements of NFPA 90A and UL listed, labeled and rated 1-1/2 hours, and in compliance with NFPA80-STD for opening protectives.

B. Provide fusible links 165 degrees F., vibration proof and secured with clinched "S" hooks or stainless steel bolts and lock nuts.

C. Smoke Dampers: Conform to UL, fit with control shafts for operation by electric or pneumatic motors. Provide a 165 degrees F thermal link.

D. Access Doors: Provide adjacent to all fire and smoke dampers.

E. Manufacturer: Subject to compliance with requirements, provide products by one of the following.

1. Ruskin Mfg. Co.
2. Controlled Air, Inc.

2.02 ACCESS DOORS

A. Standard: Conform to SMACNA.

B. Location: Provide access doors in casings, plenums and ducts where shown on Drawings and where specified for ready access to operating parts including fire dampers, smoke dampers, valves, and concealed coils.

C. Pressure Classification: Construct and install access doors in accordance with SMACNA Standards to suit the static pressure classifications and the locations where installed.

D. Access Doors in Ducts: Provide and size doors as follows.

1. Minimum 24-inch by 24-inch clear opening.
2. When field conditions require an access opening smaller than 16-inch by 12-inch, provide a 24-inch long removable section of casing or duct, secured with quick acting locking devices, 6 inches on centers, to permit ready access without dismantling other equipment.

E. Door Requirements: Provide doors in casings and duct as follows.

1. Arrange doors so that system air pressure will assist closure and prevent opening when the system is in operation.
2. Coordinate doors and equipment to provide unrestricted passage through clear door opening, without removal of any equipment.
3. Where pressure regulating dampers are installed in ducts or plenums, provide access doors with a clear wire glass observation port, 6-inch by 6-inch minimum size. Anchor port with structural metal frame, resilient gaskets and stainless steel bolts.

F. Manufacturer: Subject to compliance with requirements, provide products by one of the following manufacturers.

1. Ruskin Mfg. Co.
2. Flexmaster USA, Inc.
3. Ductmate Ind., Inc.
4. United McGill Corp.

2.03 TURNING VANES

A. Acoustic Turning Vanes: Construct of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

B. Manufacturer: Subject to compliance with requirements, provide products by one of the following manufacturers.

1. Air Filter Corp.
2. Anemostat Products Div., Dynamics Corp. of America.
3. Duro-Dyne Corp.
4. United McGill Corp.

2.04 MANUAL DAMPERS

A. Provide dampers of single blade (butterfly) type, constructed in accordance with SMACNA Duct Standards.

B. Provide dampers of multiple, opposed-blade type, constructed in accordance with SMACNA Duct Standards.

C. Bearings: Two piece molded synthetic.

D. Axles: 1/2" plated steel hew.

E. Control Shaft: 1/2" diameter.

F. Finish: Mill.

G. Manufacturer: Subject to compliance with requirements, provide products by one of the following manufacturers.

1. Ruskin Mfg. Co.
2. Controlled Air, Inc.
3. United McGill Corp.

2.05 INTAKE OR EXHAUST DAMPERS

A. General: Provide low leakage, airfoil dampers; opposed blade arrangement; AMCA rated 6 CFM/sq. ft. at 4" w.g.

B. Construction

1. Frame: 6063T5 extruded aluminum hat channel 0.125 wall thickness 5" x 1" (5" x 1/2" top and bottom 12" high or less).
2. Blades: 6" wide 6063T5 heavy gage extruded aluminum airfoil shape with extruded metal (aluminum) jam seals.
3. Linkage: Concealed.

4. Operators: Control operators specified under "Controls" Section, and is work of Division 23.

C. Manufacturer: Subject to compliance with requirements, provide products by one of the following manufacturers.

1. Construction Specialties, Inc.
2. Ruskin Mfg. Co.
3. Arrow United Industries, Inc.

2.06 FLEXIBLE CONNECTIONS

A. Fans: Provide flexible connections between fans and ducts or casings where indicated on the Drawings or required to accommodate expansion and vibration.

B. Material: Construct connections of cotton duck, minimum 20 ounces per square yard.

C. Elevated Temperature: For temperatures in excess of 100 degrees F., and corrosive, acid alkali or garage exhausts use close woven glass cloth, double neoprene coated, minimum 28 ounces per square yard.

D. Length: Limit flexible connections to 4-inch active length in the direction of airflow.

E. Standard: Construct in accordance with SMACNA Standards.

F. Attachment: Attach to fans, casings and ductwork as specified by manufacturer.

G. Manufacturer: Subject to compliance with requirements, provide products by one of the following manufacturers.

1. Vent Fabrics, Inc. or equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90 degree elbows in supply and exhaust air systems, and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

D. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.

E. Field quality control - operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233400 – FANS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of fan work is indicated on Drawings and Schedules, and by requirements of this section.

B. Types of fans required for this project include the following:

1. Centrifugal fans

C. Vibration isolation required for fans is specified in other Division 23 sections, and is included as work of this section.

D. Refer to Division 26 sections for wiring work, not work of this section.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, clearly indicating dimensions, weights (shipping and installed), furnished accessories, motor efficiencies, installation and start-up instructions.

B. Shop Drawings: Submit shop drawings showing unit dimensions, details, method of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply and control wiring to equipment. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

D. Maintenance Data: Submit maintenance data and parts list for each type of equipment, and accessory. Include this data and product data in maintenance manual, in accordance with Division 01 requirements.

1.03 QUALITY ASSURANCE

A. Provide fans which have been tested and rated in accordance with AMCA Standards and bear AMCA Certified Rating Seal.

B. Provide fans which have been listed and labeled by UL.

C. Provide motors and electrical accessories complying with NEMA Standards, and complying with NEC Code for workmanship and installation requirements.

D. The manufacturer shall guarantee the fan to deliver the full quantity of air specified under the conditions stipulated without excessive vibration and with low noise level. Fans to have AMCA certified ratings based on tests made in accordance with AMCA Standard 210 and bear the UL label.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver fans with factory installed shipping skids and lifting lugs, pack components in factory fabricated protective containers.

B. Handle fans carefully to prevent damage to components and finish. Do not install damaged components.

C. Protect components from weather, dirt, construction traffic, etc.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL FANS

A. General: Provide centrifugal fans of size, type, arrangement and capacity as scheduled on Drawings, and as specified herein.

B. Ratings: Test and rate fans in accordance with ASHRAE Standard 51 (AMCA Standard 210). Provide fans bearing AMCA Certified Ratings Seal.

C. Fan Units: Provide factory assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, vibration isolators, and side support structure. Clean, condition, and prime paint sheet metal parts prior to final assembly.

D. Housings: Provide curved scroll housings, lockseam construction for sizes 24 inches to 40 inches, spot welded construction for sizes 44 inches to 60 inches, and continuous weld construction for sizes 66 inches and larger. Provide horizontally split housings, bolted together for sizes 66 inches and larger. Provide spun inlet cones and duct connections.

E. Wheels: Provide BI / FC / Airfoil type blades (see schedule on drawings). Weld blades to wheel rim and hub plate. Key wheels to shafts. True and dynamically balance wheels after assembly.

F. Shafts: Construct of AISI C 1040 or C 1045 solid hot rolled steel, turned and polished.

G. Bearings: Provide heavy duty, grease lubricated, precision anti-friction ball or roller, self-aligning, pillow block type bearings selected for minimum average life (AFBMA L 50) of 100,000 hours.

H. Motors

1. Motor characteristics: Except where more stringent requirements are indicated, comply with the following requirements for motors:

    a. Temperature rating: Rated for 40 degrees C environment with maximum 50 degrees C temperature rise for continuous duty at full load (Class A Insulation.

    b. Starting capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

    c. Phases and current characteristics: Provide motors as scheduled; squirrel-cage induction polyphase motors for 1/2 hp and larger, and provide capacitor-start single-phase motors for 1/3 hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split phase type. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

    d. Service factor: 1.15 for polyphase motors and 1.35 for single-phase motors. All motors shall be premium efficiency type, in conformance with LIPA commercial energy rebate program.

e. Motor construction: Provide general purpose, continuous duty motors, Design "B", except "C" where required for high starting torque.

1) Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading.

2) Enclosure type: Except as otherwise indicated, provide totally enclosed, fan cooled (TEFC) motors for indoor use. Provide weather protected Type I for outdoor use.

3) Efficiency: Provide premium efficiency motors with efficiency as required to conform with current LIPA commercial energy rebate standards.

f. Name plate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

I. Drives: Provide V-belt drive, selected for 1.4 service factor. Provide adjustable pitch sheave, selected for midpoint at design conditions.

J. Accessories: Provide the accessories as indicated on the schedule on the project drawings.

K. Manufacturer: Subject to compliance with requirements, provide centrifugal fans of one of the following:

1. Carnes Company Inc.
2. Greenheck Fan Corp.
3. Twin City Fan Corp.

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FANS

A. General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to ensure that fans serve their intended function.

B. Coordinate with other work of as necessary for proper interfacing.

C. Electrical Wiring: Ensure fans are wired properly, with rotation in intended direction for proper performance. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.

3.03 FIELD QUALITY CONTROL

A. Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.04 SPARE PARTS

A. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven item.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233543 – VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Variable frequency drives indicated by Drawings and Schedules.

B. Variable frequency drive reactors or isolation transformers.

1.02 SUBMITTALS

A. Submit manufacturer's data on variable frequency drives and motors.

B. Shop drawings of AFC, reactors, and wiring diagrams shall be provided with list of parts including fuses and breakers.

C. Maintenance Data - submit maintenance data and spare parts list for variable frequency drives and motors. Include this data in Maintenance Data.

1.03 QUALITY ASSURANCE

A. Comply with NEC as applicable to wiring methods, construction and installation of variable frequency drives and motors.

B. Comply with applicable requirements of UL 508, "Electrical Industrial Control Equipment", pertaining to variable frequency drives. Provide variable frequency drives and motors which have been UL listed and labeled.

C. Comply with applicable portions of NEMA Standards pertaining to motor controllers/starters and enclosures.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store variable frequency drives in clean dry place prior to installation. Protect from weather, dirt, fumes, water and physical damage etc.

B. Protect after installation similarly. Do not install until location is enclosed and weathertight.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Provide products of one of the following:

1. Reliance Electric VTAC V
2. Toshiba
3. Mitsubishi Electric

B. General

1. Provide AFC suitable to serve as starter and a disconnect to the motor.

2. The adjustable frequency controller (AFC) together with all options and modifications shall mount within standard NEMA 1 enclosure suitable for continuous operation with a maximum ambient of 40 degrees C.
3. All high voltage component within enclosure shall be isolated with steel covers.
4. The complete unit shall be UL approved and labeled as an assembly.
5. The AFC shall not emit any measurable electro magnetic interference at a distance of 3 feet from unit.
6. Convert 60 Hz line frequency and voltage to stepless motor control from 10 percent to 110 percent of base speed.

C. Electrical Characteristics

1. DV/Dt and Di/Dt protection for semiconductors.
2. Capable of starting into a rotating load without delay.
3. Protective circuits shall cause instantaneous trip (IET) should any of the following faults occur:

    a. 110% of controller maximum sine wave current rating is exceeded.
    b. Output phase to phase short circuit condition.
    c. Low input line voltage.
    d. Loss of input line voltage.
    e. Loss of input phase.
    f. External fault. This protective circuit shall permit, by means of terminal strip, wiring of remote NC safety contacts such as high static, firestat, etc., to shut down the drive.

4. The following adjustments shall be available in the controller:

    a. Maximum frequency (55 to 66 Hz) factory set at 60 Hz.
    b. Minimum frequency (6 to 35 Hz) factory set 6 Hz.
    c. Acceleration (2 to 20 seconds) factory set at 20 seconds.
    d. Deceleration (2 to 20 seconds) factory set at 20 seconds.
    e. Volts/Hertz ratio factory set for 460V at 60 Hz.
    f. Voltage offset or boost factory set at 100% torque.
    g. Current limit (50% of 110% sine wave current rating) factory set at 100% current.

5. Door mounted operator controls.

    a. Auto/manual switch.
    b. Start/stop (reset) switch.
    c. Manual speed control.

6. Automatic mode, controller will follow an external signal and respond to remote start-stop contact wired to terminal strip. LED's will be door mounted and will indicate power on, drive fault, motor running and external fault.

7. Input disconnect: Provide a positive disconnect between the controller and all phases of the incoming A-C line. This disconnect shall be designed to mount inside the controller enclosure and include a mounting bracket and through-the-door interlocking handle with provisions for padlocking.

    a. The basic switch shall be thermal magnetic, molded case circuit breaker.

D. Motor overload: Contains thermal overload relay designed to protect one A-C motor, operated on AFC output, from extended overload operation.

E. Isolated Process Control Interface: Enables the AFC to follow a 0-5, 1-5, 4-20 10-50 ma; 1-4, 0-8, 0-10 VD-C grounded or ungrounded signal from a process controller.

F. Voltage, current and Frequency Meters: Provide to indicate the output voltage, output frequency and output current.

G. Plug-in Tester Card: Provide a quick means for monitoring the different signals within the AFC for start-up and troubleshooting. The tester card printed circuit board shall be a 44 pin type which can be plugged into AFC regulator rack. One tester shall fit all AFC units.

H. Provide shielded isolation transformer to change voltage from 208V/3PH/60Hz input to 460V/3PH/60 Hz output, for supply fans only.

I. The AFC shall have an auxiliary contact that will send a run/start indication to the temperature control system.

2.02 LINE REACTORS

A. Provide line reactors for wiring upstream of the AFC. The reactors shall be sized for the maximum current of the drive with the reactance to match the AFC.

PART 3 - EXECUTION

3.01 INSTALLATION OF VARIABLE FREQUENCY DRIVES AND MOTORS

A. Install AFC and motors as indicated, in accordance with manufacturer's written instruction, applicable requirements of NEC, NEMA Standards, and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate with General Contractor and Division 26 Contractor for installation and wiring of AFC's and motors.

C. Ensure three phase motors are rotating in correct direction.

D. Provide positive electrical equipment and motor groundings.

3.02 ADJUST AND CLEAN

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.03 FIELD QUALITY CONTROL

A. Subsequent to wire/cable hook-up, energize motor starters and motors, and demonstrate functioning of equipment in accordance with requirements, were necessary correct malfunctioning units.

3.04 START-UP AND WARRANTY SERVICES

A. The manufacturers shall provide start-up services, completely checking out the operation and performance of the variable frequency drive. Manufacturer shall furnish Owner with Operation and Maintenance instructions including four (4) sets of operations and maintenance manuals with full parts list.

B. The manufacturers shall provide a one-year full parts and labor warranty from date of start-up and owner acceptance.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233600 – AIR TERMINAL UNITS

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Extent of air terminal unit work is indicated on Drawings and Schedules, and by requirements of this section.

B. Types of air terminal units specified in this section include the following:

1. Variable air volume units.

C. Refer to HVAC Controls sections for field controls work.

D. Refer to Division 26 sections for power wiring work, not work of this section.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, clearly indicating dimensions, weights (shipping and installed), furnished accessories, installation and start-up instructions. Provide units of same manufacturer if various types of terminals required on same project.

B. Shop Drawings: Submit shop drawings showing unit dimensions, details, method of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply and control wiring to equipment. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

D. Maintenance Data: Submit maintenance data and parts list for each type of equipment, and accessory. Include this data and product data in maintenance manual, in accordance with Division 01 requirements.

1.03 QUALITY ASSURANCE

A. Provide units which have been tested and rated in accordance with AMCA Standards and bear AMCA Certified Rating Seal.

B. Provide water reheat coils which have been tested and rated in accordance with ARI and ASHRAE Standards and bear ARI Certified Rating Seal.

C. Provide units and electric reheat coils which have been listed and labeled by UL.

D. Provide units which have been listed and labeled by NFPA.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver units with factory installed packing and protective containers.

B. Handle units carefully to prevent damage to components and finish. Do not install damaged components; replace with new.

C. Protect components from weather, dirt, construction traffic and debris, etc. while on project site before installation.

PART 2 - PRODUCTS

2.01 VARIABLE AIR VOLUME UNITS

A. General: Provide single or dual duct pressure independent variable air volume terminal units as scheduled, consisting of a variable volume damper and actuator or motor drive, adjustable air volume regulator, and other items as required for proper operation.

B. Casing: Provide zinc-coated steel casing 22MS gage minimum, hemmed, cross broken and reinforced to form a rigid unit.

1. Casing: With removable panels large enough to provide access to all moving parts, for inspection, adjustment, and maintenance, without disconnecting ducts.
2. Panels: Flush, gasketed airtight, and held in place by screwdriver operated latches or sheet metal screws.
3. Total leakage from casings: per ASHRAE 90.1

C. Lining Material: Provide lining materials in conformance with NFPA 90A and UL 181.

1. Inside surfaces: Lining material suitable to provide required acoustic performance, thermal insulation, and prevent sweating.
2. Lining thickness: Not less than 1/2-inch.
3. Lining: Secure to supporting surfaces in such a manner that it will not delaminate, sag, or settle.
4. Surfaces, including edges: Face with perforated metal or coated so that material is not detached by the air stream and protected on the cut edge.

D. Dampers: Provide dampers and other internal devices constructed of materials that cannot corrode and do not require lubrication or other periodic servicing.

1. Leakage Rates: Not exceeding 9 cfm when close-off pressure differential is 6 inches W.G.

E. Controls: Provide all interior controls factory furnished and installed. Provide factory installed external DDC damper actuators compatible with the building BMS.

F. Air Volume Controllers: Provide units with integral air volume controlling dampers to supply a variable volume of air to remote air supply diffusers through ductwork as indicated on the Drawings.

1. Static pressure independent maximum volume regulators: Field adjustable and calibrated in CFM (or have calibration charts) and field or factory adjusted to the quantities indicated on the Drawings.
2. Air volume: Varied in response to the demands of the thermostat in the conditioned space, or mounted in the unit if room air is induced over the thermostat (provide thermostat).

G. DDC Controls: Provide direct digital electronic controls (DDC) on terminals, including all necessary power supplies and accessories, which operate on 24 VAC or 24 VDC. Provide volume regulator settings from 0 percent of maximum volume to 100 percent of maximum terminal unit volume. Construct units to regulate air volume within plus or minus 1-1/2 percent of setting. Allow control adjustment from 65 to 85 degrees F., accurate to plus or minus 1.0 degrees F.

H. Reheat Coils: Provide variable volume units with one, two, three, or four row hot water or electric reheat coil, as indicated on drawing schedules.

1. Select coils for entering water temperature and capacity as shown on schedules.
2. Sequence of operation: As indicated on Drawings and Specifications.

I. Sound Attenuators: Provide integral sound attenuator to minimize downstream noise discharged to room.

J. Sound Ratings: Rate unit sound power in accordance with AHRI-885. Do not allow sound powers over the full throttling range of the unit to exceed the maximum sound powers listed on the Drawings.

K. Manufacturer: Subject to compliance with requirements, provide variable air volume units of one of the following:

1. Titus, Div. Tomkins Industries, Inc.
2. Trane Co.
3. Anemostat Products, Div. Dynamics Corp.
4. Carrier Corp.
5. Carnes Co., Div. of Wehr Corp.

PART 3 - EXECUTION

3.01 INSTALLATION OF AIR TERMINAL UNITS

A. General: Install units as indicated on the Drawings and in accordance with manufacturer's installation instructions. Coordinate work with other trades.

B. Supports: Provide units rigidly supported so that they remain stationary at all times.

3.02 FIELD QUALITY CONTROL

A. Testing: After installation of fans has been completed, test each unit to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.03 BALANCING

A. Refer to Division 23 Section 230593, “Testing and Balancing" for air balancing of fan systems; not work of this section.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 – GENERAL

1.01 SUMMARY OF ITEMS INCLUDED

A. Scope: Extent of air diffuser and register work required in this Section is indicated on the Drawings and schedules and by the requirements of this Section.

B. Types required for project include the following:

1. Ceiling air diffusers.
2. Wall and duct registers and grilles.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's standard technical product data including capacity ratings, throw, drop, diffusion, terminal velocities, noise levels, adjustability, construction details, finish and mounting details.

B. Shop Drawings.

1. Provide dimensioned shop drawings of linear diffuser mounting, plenum dimensions, plenum connections, damper connections and branch ductwork connections.

a. Draw shop drawings showing plans, sections, mounting details and finishes.
b. Furnish certified test data, including acoustical performance of the air troffer/boot combination with maximum air quantities indicated on the drawings.

C. Schedule: Submit a schedule of proposed air diffusers, registers and grilles, keyed to the Contract Drawings and indicating the proposed type, size, air quantity, pressure drop and location of each device proposed under this Contract.

1. Manufacturer: Same for all diffusers and registers on project.

1.03 QUALITY ASSURANCE

A. ASHRAE: Test and rate air outlets and inlets in certified laboratories under the requirements of ASHRAE Standard 70.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Original Containers: Deliver air diffusers and registers to the site in manufacturer's original containers. Identify on outside of container type and location to be installed.

B. Protect From Damage: Do not install bent, marred or damaged devices. Replace with new. Store indoors, where possible, or outdoors in weatherproof enclosures above grade.

PART 2 - PRODUCTS

2.01 AIR DIFFUSERS AND REGISTERS: GENERAL

A. Construction: Provide devices as specified on drawings.

1. Treat steel with zinc phosphate or zinc chromate after fabrication.
2. Grind, polish and factory prime.
3. Factory finish with white baked enamel finish, unless otherwise indicated.
4. Roll or reinforce exterior faces and edges.
5. Ensure mitered joints and butt connections mate within 0.010-inch maximum crack.
6. Surface finish: Smooth within 0.005-inch at welds, joints, clamping points and splices.
7. Offsets and bends: Mitered.
8. Mate devices with the associated duct, plenum or boot to form an airtight joint.

B. Provide as scheduled on Drawings.

2.02 SUPPLY OR RETURN REGISTERS

A. Register Type: Adjustable single or double-deflection type, formed steel or extruded aluminum, as indicated on the Drawings; noise levels of NC 20 or less.

B. Bars: Provide adjustable or fixed face bars and fixed rear bars, as indicated by types on Drawings.

C. Frames: Provide stamped or rolled steel or extruded aluminum frames fitted with felt, neoprene or plastic gaskets.

D. Dampers: If indicated on drawings provide register dampers of formed steel, cadmium plated, gang key operated, opposed blade type, and arranged so that the operating mechanism does not project through any part of the register face.

E. Mounting Hardware: Provide round or countersunk head Phillips screws.

F. Air Extractors: Provide 18 gage frames, 22 gage curved steel blades, fixed pattern, screwed to the duct collar, and sized to match register dimensions.

G. Manufacturer: Subject to compliance with requirements, provide registers of one of the following:

1. Titus Products.
2. Anemostat Products Division, Dynamics Corp.
3. Carnes Co., Division of Wehr Corp.

2.03 RETURN GRILLES

A. Construction: Construct as specified for registers, except omit register damper.

B. Bars: Provide fixed horizontal face bars with 1/2-inch spacing and 35 degree downward blade angle.

C. Filters: If indicated on drawings provide 1-inch throw-away filters for return grilles.

D. Manufacturer: Subject to compliance with requirements, provide grille units of one of the following:

1. Titus Products.
2. Anemostat Products Division, Dynamics Corp.
3. Carnes Co., Division of Wehr Corp.

2.04 CEILING DIFFUSERS

A. Ceiling Diffusers: Provide circular, square or rectangular, as indicated on the Drawings; noise levels as indicated on drawings.

B. Diffuser Edge and Framing Details: Compatible with the type of ceilings in which the diffuser is installed. For plaster ceiling provide plaster frames or plaster rings, set flush with finished ceiling.

C. Materials: Refer to drawings.

D. Access: Provide removable internal parts of circular, square or rectangular diffusers, including volume regulators, diffuser face, dampers and equalizing devices.

1. Allow removal of parts, including internal assembly, without the use of special tools.
2. Do not allow removal of diffuser face to disturb the distribution pattern.

E. Finish: Provide baked enamel finish on visible face. Coordinate color with Architect.

1. Interior and concealed parts: Flat black or dark gray.

F. Adjustable Pattern: Provide adjustable pattern diffuser cones to vary the distribution from horizontal parallel to the ceiling to a downward distribution pattern into the space, not on exposed face.

G. Pressure Range: Design to allow equal distribution pattern, both horizontal and vertical, for diffusers with pressure drops from 0.10 to 0.40 inches water gage.

H. Dampers, Diffusers, and Extractors: Products of the same manufacturer.

I. Extractors: Provide adjustable extractors, furnished by the diffuser manufacturer, in each ceiling diffuser where indicated on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordination: Coordinate the location of grilles, registers and diffusers with other trades. Examine areas and conditions under which inlets and outlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

1. Examine architectural floor plans, reflected ceiling plans and elevations and arrange for duct taps to be so placed that the installation of air outlets will present a uniform relationship with architectural features, lighting, sprinkler heads, speakers and smoke detectors.
2. On plain walls, if not otherwise indicated, locate sidewall registers approximately 8 inches down from the finished ceilings.
3. Adjust the face and rear bars of supply registers to provide a diffusion pattern such that the terminal velocity point is approximately 70 percent of the "room" width and 5 to 6 feet above the finished floor, at a velocity of 20 to 50 fpm.
4. On projects with reflected ceiling plans, locate outlets to conform to that plan.
5. If no reflected ceiling plans are included in the Contract Documents, coordinate the location of air outlets with other trades before cutting in ceiling and sidewall taps. Provide coordination drawing in shop drawings.

END OF SECTION

Division 23-Mechanical
234568-Hydronic Finned Tube Radiation

2.1 General

A. The contractor shall furnish and install Rittling Regency F-Series Fin Tube Enclosure with required mounting components and accessories to meet size, capacity and characteristics as required on the Equipment Schedule or on the plans.
B. Units shall be installed in a neat and workmanlike manner in accordance with specifications and manufacturer recommendations.
C. All material shall be manufactured by Zehnder Rittling or Approved Equivalent.

2.2 Heating Elements

A. Copper heating elements, as indicated on the plans, shall consist of aluminum fins not less than .016" thick with integral fin collars, which space the fins and provide good tube to fin surface contact, permanently bonded to copper seamless drawn tubing by mechanically expanding the copper tubing, to ensure durability and eliminate noise from loose fins, while assuring performance at specified catalog ratings.
B. The ends of the tube shall be finished OD (male) on one end and finished ID (female swaged) on the other end as to allow the use of standard domestic copper fittings.
C. Elements will be provided from 1 ft to 12 ft lengths in 6" increments.

1. Copper tube nominal diameter: ¾"
2. Fins per foot: 48
3. Fin dimensions: 4¼" x 4¼"

2.3 Enclosures

A. Enclosures shall be of the size and style as shown on the plans.
B. Enclosures shall be manufactured from 16-gauge cold rolled steel.
C. All enclosures shall be reinforced with a (minimum of two) gussets welded at ends of each enclosure style.
D. The joining of enclosure shall be accomplished by use of internal joggle joiners providing added rigidity and alignment with adjoining enclosures.
E. No sheet metal screws or other fastening devices shall be visible.
F. Air discharge and inlet louvers will be of a “pencil proof” design.
G. Enclosures will be provided from 1 ft to 8 ft lengths in 6" increments.

1. The upper portion of the enclosure will be secured in a hinge type manner by use of a full length roll formed mounting channel, while the lower portion of the enclosure will be secured to steel snap expansion brackets by use of a positive locking, bottom mounting clip using fasteners thus preventing removal without tools.

2.4 Finish

A. All enclosures and accessories shall be degreased and chemically phosphatized before application of a durable, attractive electrostatic epoxy powder coating.
B. Color to be selected from standard Zehnder Rittling color chart by Architect or Record.

2.5 Submittals

A. All submittal must include a room-by-room schedule showing element output at scheduled water temperatures and glycol concentration. Catalog data and correction factors will not be acceptable.

Accessories and Options

A. Mounting channel shall be die-formed from 23-gauge galvannealed steel. The top projection of the mounting channel or full back plate shall position the enclosure away from the wall so as to allow for installation or removal of enclosure without damage to wall. Where noted on drawings or schedules a urethane gasket shall be provided with the unit to form air seal at wall.

B. Snap expansion and second row brackets shall be die-formed from 16-gauge galvanneal for rigidity. Snap expansion brackets shall incorporate a positive locking, bottom mounting clip for fastening the enclosure, as well as supporting one row of finned tube. Brackets shall be self-gauging, allowing for a single measurement installation. All brackets must provide for lengthwise movement of elements during expansion and contraction as well as aligning elements to prevent contact with walls or enclosure.

C. Access doors shall be provided in 12" long access panels or in the enclosure where noted on plans. The doors shall have an overall size of 6" x 6" as standard (size may vary as space becomes limited) and be installed where flow control or shut off valves are located. Doors shall be hinged at the top and use a slotted fastener to operate. Recessed security Allen head operators shall be used in secure areas as indicated.

D. A variety of trim pieces may be used between ends of enclosures and walls on wall-to-wall installations (inside corners, outside corners, wall trims, end caps and removable access panels). Trims may be overlapping or butt-type depending on the application. All trims will be manufactured from 18-gauge cold rolled steel.

E. Units shall be manufactured in accordance with conformance to ISO 9001:2000 standards.

DIVISION 23 – MECHANICAL

Section 235200 – Cast Iron Boilers, Burners, Lead Lag Equipment

2.01 GENERAL DESCRIPTION:

A. Furnish and install as herein specified, shown or scheduled on the Contract Drawings, one (2) new Boiler/Burner units for hot water heating service and arranged for completely automatic operation firing #2 Oil.

B. The Boiler/Burner system, it's installation and all equipment associated with the operation of the system shall comply with all applicable codes. The contractor is cautioned that all aspects of the installation shall specifically meet the requirements of ASME Code Rule 4, NFPA 31 UL, FM and NYS code rule 4.

C. Boilers shall be furnished complete with an insulated metal jacket, forced draft burner, smoke-hood with integral 14 gauge aluminized steel damper; pressure tight front and rear flame observation ports with covers; cast iron burner mounting plate with insulation and additional controls and devices as hereafter specified.

D. Boiler/Burner unit shall have been rated in accordance with AHRI Testing and Rating Standard for Heating Boilers, and shall be performance tested and listed by UL at +0.10 ins. Capacities shall be as noted on the schedule drawing.

E. Boiler/Burner unit shall be a model BL88-W series 2 as manufactured by Weil McLain Boilers.

2.02 BOILER CONSTRUCTION/INSTALLATION:

A. Boiler shall be a Cast Iron sectional unit of the wet base type designed for pressure firing and it shall be constructed and tested for 80 PSI Maximum water working pressure in accordance with the A.S.M.E. Section IV Rules for the Construction of Heating Boilers. Individual sections will have been subjected to a hydrostatic pressure test of 125 PSIG at the factory before shipment and they shall be marked, stamped or cast with the A.S.M.E. Code symbol.

B. Boiler construction - Boiler sections are assembled with short, individual draw rods and cast with sealing grooves for high temperature sealing rope to assure permanent gas-tight seal. The boiler waterside shall be sealed watertight by elastomer sealing rings, not cast iron nipples. Each port opening is machined to completely capture sealing ring between sections. The hydro-wall design to provide completely water-cooled combustion chamber and provided with sufficient tappings to install required

controls. The vessel shall have a limited 10-year warranty against workmanship and defects to be in writing by manufacturer.

C. The boiler shall include the following features:

1. Designed with a low silhouette to provide maximum headroom.
2. Furnished with insulated burner mounting plate having necessary holes and tappings to mount burner. High temperature sealing rope is used to provide permanent gas-tight seal between front section and plate.
3. Furnished with two observation ports (one in front and one in back) to allow visual inspection of the flame.
4. Provided with cast iron flue collar with a built-in adjustable damper capable of being locked into place after adjustment.
5. High temperature sealing rope used to provide permanent gas-tight seal between hood and section assembly.
6. Furnished with heavy gauge cast iron cleanout plates to cover cleanout openings on the front of the boiler(s).
7. Port openings must be of captured seal design – a machined groove assures uniform compression of the sealing ring and protects the seal from contaminants. Elastomer sealing rings are to be used to provide permanent watertight seal between sections. Unlike cast iron or steel push nipples, the elasticity of the seals fills any gaps caused by misalignment or expansion or contraction.
8. Shipped with insulated heavy gauge steel jacket(s) with durable powdered paint enamel finish. Jacket designed to be installed after connecting supply and return piping. Side panels can be removed without tools for easy servicing.

D. All boiler discharges shall be piped to floor drains as shown on the Contract Drawings and as indicated by the Consulting Engineer. Blowdown valves shall be Brass, ball type and not less than one inch IPS and they shall discharge to a floor drain or away from the boiler as directed by the Consulting Engineer. Pipe ends shall be cut at a 45 Degree to prevent a cap or plug from being installed. All such discharge piping shall be supported by hangars or stand-offs to prevent the valve body from undue stress or strain. Boiler drain valves shall be connected to the lowest water space available and shall be installed with pipe and fittings to connect the bottom blowoff full size to drain.

E. Stop valves shall be provided in the supply and return pipe connections to the boiler. Provisions shall be made for the expansion and contraction of the heating mains connected to the boiler by providing substantial anchorage at suitable points and assisted by the use of swing joints to allow the piping to expand and contract without imposing excessive forces on the boiler piping.

F. Boiler shall be furnished as a knocked down unit for field assembly, erection and connection on site and it shall be furnished with all castings, fittings and appurtenances

necessary for the assembly, connection and operation of the boiler as specified. Boiler installation shall be accomplished within acceptable A.S.M.E. piping practices and requirements and in strict accordance with the boiler manufacturer's recommendations and instructions.

2.03 WATER TRIM:

A. The boiler shall have the following minimum trim items:

1. A.S.M.E. schedule side outlet safety valve set for 50 PSI
2. pressure / temperature gauge
3. Honeywell L4006A operating control
4. Honeywell L40006E high limit control
5. Siemens RWF50 modulation control
6. McDonnell & Miller # 751 probe LWCO
7. McDonnell & Miller # 63M LWCO manual reset with TC-4 test & check valves

2.04 OIL BURNER UNIT:

A. Furnish and install as indicated herein Underwriters Labeled # 2 oil burner on each Weil McLain boiler. The burner design, construction, components and installation shall meet all applicable code requirements.

B. The burner shall be a Power Flame model CR as noted on the schedule drawing. . Each burner shall be capable of firing its respective boiler to full rate.

C. Each burner shall be listed by Underwriters Laboratories and shall bear the appropriate U.L. label. In addition to the U.L. requirements, all equipment and installation procedures will meet the requirements of FM, NFPA 31 & 54 and ASME CSD-1. Each burner shall be designed and constructed as an integrated combustion system package and shall be factory fire tested.

D. Each burner shall be of welded steel construction. The combustion head shall incorporate a multi blade, stainless steel, flame retention diffuser. Burners with cast alloy blower housings will not be accepted.

E. All air required for combustion shall be supplied by a blower-mounted integral to the burner. The blower wheel shall be of the forward curved centrifugal design and shall be directly driven by a 3450 RPM three phase motor. A dual blade damper assembly located on the inlet side of the blower wheel shall meter the combustion airflow. Design shall permit the disconnecting and locking of either damper if firing rates are near minimum burner input ratings.

F. Ignition for # 2 oil shall be by direct spark with a separate transformer and electrode system.

G. Dual solenoid oil valves shall control the main On-Off oil supply. An electronic air/fuel controller shall control the modulated positioning of the air inlet dampers, and a metering type oil valve, to best meet varying system load conditions.

H. Burners shall be equipped with a Siemens Parallel Positioning Electronic Fuel Air Ratio Controller with two boiler lead lag control. The system will allow independent fuel profiles. The parallel positioning system shall provide for a minimum of 7 and a maximum of 24 set points to provide for maximum efficiency and high turndown. Independent servo drive motors shall be used for each fuel and for the burner motor air damper. Standard rod and swivel linkage type systems shall not be considered as an acceptable alternative.

I. The system shall have independent light off and minimum modulation set points. The controller shall provide for integrated boiler shock protection algorithms, based on water temperature low fire hold or stack temperature low fire hold. The system shall be able to accommodate future flue gas recirculation.

J. The positioning of the servomotors shall be controlled by a 4-20 milliamp, or 0-10 VDC, modulating type pressure controller. When the operating control is satisfied the burner shall shutoff and return to the low fire start position. The motors shall provide an electrical interlock to insure a guaranteed low fire start position prior to the pilot trial for ignition sequence.

K. The fuel/air control system shall be UL approved and shall be marked with identifying labels. The system shall be Siemens LMV3 with AZL screen display or approved equal.

L. Each burner shall incorporate U.L. approved components as supplied by the burner manufacturer to provide specified Fuel/Air Control System operation.

M. Furnish and install on each burner a complete oil control train. The oil train shall incorporate U.L. approved components as supplied by the burner manufacturer to provide specified Fuel/Air Control System operation.

N. The high-pressure nozzle supply oil pump shall be a two (2)-stage gear type capable of producing 300 PSIG discharge pressure and 15 in. hg. vacuum. The oil pump shall be integral for the blower drive shaft. The unit shall be complete with suction line manual gate valve, removable mesh type oil strainer, 0-30" HG. 0-30 PSIG vacuum/pressure gauge, 0-300 PSIG oil nozzle pressure gauge and nozzle line solenoid safety shutoff oil valve.

O. Additional oil components shall be provided as follows:

1. Oil nozzle line auxiliary solenoid safety shutoff oil valve.

2. Low oil pressure switch.

3. Fuel Oil strainer – 100 micron.

P. The outside air damper and or fan systems will be electrically interlocked with the burner operating circuit to insure that the burner will not operate if the outside air damper has not been driven open. All system circuitry shall be interlocked with the burner circuitry to insure correct sequencing of all combustion system components.

2.05 BURNER CONTROL PANEL

A. Each burner shall be complete with an integral mounted control panel that shall house all required operating electrical components. All wiring within the combustion system shall be pre-wired to a terminal strip mounted within the control panel. Appropriate electrical knockouts shall be provided on both sides of the panel to allow for necessary power and limit control wiring. The control panel shall be constructed of 16-gauge steel and shall be complete with a top switch and control section that shall be hinged to allow for full access to all panel mounted components. The control panel shall be painted in a color and finish identical to the burner being supplied.

B. The control panel shall include a control circuit transformer fused on both the primary and secondary windings - flame safeguard control as specified above-On-Off switch - motor starters for burner motor oil pump motor and blend pump motors, circuit breakers, relays, alarm bell (to ring on low water, flame failure, high limit, low oil pressure) w/automatic reset silencing system, terminal blocks, main disconnect switch, single point power feed and other electrical devices as required. All wiring shall be color coded and the manufacturer shall include ladder type wiring diagrams.

C. The flame safeguard control system shall include Ultraviolet sensor for flame detection and provide fully automatic sequencing of pre-purge and post-purge, blower motor, interrupted ignition system, and fuel/air flow components. The flame safeguard control shall be the Siemens LMV3 with keypad operator interface

D. The control panel shall be furnished with burner indicating lamps to annunciate and provide burner status. The following points shall be annunciated on the Graphic Display:

1. Power On – Green
2. Demand – Green
3. Modulation Mode – Green

4. Flame Failure – Red
5. Low Water Cutoff – Red
6. High Limit – Red
7. Low Oil pressure

E. Each burner control panel to include the following interfaces:

1. Interlock for break glass station
2. Interlock for fresh air damper
3. Interlock for remote alarm
4. Interface for BMS system for common alarm and boiler on status.

2.06 BOILER MASTER CONTROL PANEL:

A. Furnish and install one (1) boiler master control panel. The panel shall be for remote wall mounting that shall house all required operating electrical components. All wiring within the combustion system shall be pre-wired to a terminal strip mounted within the control panel.

B. Appropriate electrical knockouts shall be provided on both sides of the panel to allow for necessary control wiring. The control panel shall be constructed of 16-gauge steel and shall be complete with a top switch and control section that shall be hinged to allow for full access to all panel mounted components. The control panel shall be painted in a color and finish identical to the burner being supplied.

C. The panel shall include the following controls and equipment:

1. On/off switch

2. Control circuit fuse

3. Power Flame Sync-matic two boiler PLC based lead/lag system w/steam transmitter capable of interfacing with the building management system using modbus & BACnet protocol. The controller shall be of the fully programmable microprocessor type and shall provide both boiler sequencing and firing rate control. Firing rate output signal shall be 4-20MA for interface with burner air/fuel ratio controls. The controller shall monitor header temperature to calculate the burners firing rate position and include boiler outlet temperature monitoring and over-ride control to avoid short cycling. The controller shall be complete with an auto / off / manual switch for each boiler to provide backup control function, digital display with programming keypad, boiler indicating lamps and control circuit protection.

4. 5. Interlock for E-stop.

6. Color-coded wiring with ladder type wiring diagram.

2.07 BOILER BURNER COMMISSIONING:

A. The contractor shall retain the services of the equipment manufacturers local authorized service representative for purposed of start up, testing and system adjustment. All testing to be complete using the manufacturers start up and testing procedure and shall be documented using the test forms found in the installation and instruction manuals. On completion of the burner system start up - the installing contractor will complete the "Burner Start up Information and Test Data" form and "Control Settings" form and deliver to the Architect and owner. The commissioning shall include but not be limited to the following:

B. The startup sheet furnished by the burner manufacturer must be complete in its entirety. A print out of the combustion readings shall be furnished and attached to the start up sheet. Combustion readings shall be by means of an electronic combustion test instrument with print out capability Actual testing shall be accomplished by a factory authorized service agency whose personnel have been trained by the burner manufacturer. The individual technician must have a minimum of five (5) years experience in start up and service of equipment of the size and complexity similar to this installation. Start up will cover all tests as outlined in ASME CSD, including fuel valve leakage test. The owner's operating personnel shall be furnished with detailed instruction manuals on the following topics:

1. Overview of the burner operation
2. Detailed instructions regarding the applicable combustion control
3. Detailed instructions regarding the modulating motor applied to the burner, including linkage.
4. Detailed oil fuel flow diagrams.
5. These items are in addition to the standard service manual provided with the equipment.

2.08 FIELD TRAINING:

A. Field training course shall be provided for staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after system is functionally complete. Field training shall cover items contained in approved safety, operation and maintenance instructions as well as demonstrations of routine maintenance operations. Mechanical contractor should notify manufacturer in writing at least 10 days prior to training.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 236000 – 2 TO 5 TON VRF SYSTEM INDOOR EVAPORATOR UNITS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Indoor Evaporator Units for 2 to 5 Ton Capacity Variable Refrigerant Flow (VRF) systems.

1.2 RELATED SECTIONS

A. Division 23 Mechanical Specifications

1.3 REFERENCES

A. United Electric Company designs and builds its Magic Aire products to comply and perform to the following standards as applies:

1. Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation.
2. AMCA 210, ASHRAE 51: Airflow
3. ARI 410: Coil Capacity – Hydronic
4. ARI 210: Coil Capacity – DX
5. ANSI/UL – 1995: Safety Agency Listing of base or standard equipment is ETL, ETL file #491893
6. Material Specifications Standards:
   a. ASTM A525, A527: Sheet Metal
   b. ASTM B68, B75, B88, B251: Copper Tubing per
   c. ASTM B209: Aluminum
7. Major Components Standards:
   a. NEMA per UL/CSA: Motors
   b. UL/CSA: Wire
   c. UL/CSA: Electrical
   d. ASHRAE 52: Filters per UL,
   e. UL 181, UL 723 (25/50), ASTM E-84: Fiberglass Insulation
   f. ASTM B117:Paint per
   g. UL-1995: Electric Heater, factory installed assembly (HB)
   h. UL-1996: Electric Heater, field-installed accessory (BM,BV)

1.4 SUBMITTALS

A. Confirm product application requirements in sufficient detail to specify product as it is to be manufactured.

1.5 QUALITY ASSURANCE

A. Coil(s) shall be factory tested for leakage at minimum of 500 psig air pressure under water.

B. Valve Package shall be factory tested to withstand 50 psi pressure degradation with no losses.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Inspection: Inspect all items for transit damage or any indication of re-pack. Follow manufacturer directions for filing freight claims.

C. Storage: Store materials in a dry, sheltered area, protected from damage and in accordance with manufacturer's instructions.

D. Handling: Handle and lift products in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturers shall be the following:

1. L.G.
2. Approved Equal.

2.2 CEILING CASSETTE – 4 WAY

A. General

1. Unit shall be manufactured by LG.
2. Unit shall be designed to be installed for indoor application.
3. Unit shall be designed to mount recessed in the ceiling and has a surface mounted grille on the bottom of the unit.
4. The unit shall be available in both nominal 2’ x 2’ and 3’ x 3’ chassis.

B. Casing/Panel

1. Unit case shall be manufactured using galvanized steel plate.
2. The unit panel shall be provided with an off-white or black Acrylonitrile Butadiene Styrene (ABS) polymeric resin grille.
3. The grille shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
4. Unit shall be provided with metal ears designed to support the unit weight on four corners.
5. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
6. Unit shall be supplied with snap off access panels to facilitate leveling of unit without removing the grille.

C. Cabinet Assembly

1. Unit shall have four supply air outlets and one return air inlet.
2. The supply air outlet shall be through four directional slot diffusers each equipped with independent oscillating motorized guide vanes designed to change the airflow direction.
3. The grille shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes.
4. The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in counterclockwise pattern.

5. Guide vanes shall provide airflow in all directions.
6. Unit shall be equipped with factory installed temperature thermistors for:
    a. Return air
    b. Refrigerant entering coil
    c. Refrigerant leaving coil
7. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
8. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
9. The unit shall have factory designated branch duct knockouts on the unit case.
10. The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
11. The branch duct knockouts shall have the ability to duct up to 1/2 the unit airflow capacity.
12. The branch duct cannot be ducted to another room.
13. Unit shall have the following functions as standard:
    a. Self-diagnostic function
    b. Auto addressing
    c. Auto restart function
    d. Auto changeover function (Heat Recovery system only)
    e. Auto operation function
    f. Child lock function
    g. Forced operation
    h. Dual thermistor control
    i. Sleep mode
    j. Dual set point control
    k. Multiple aux heater applications
    l. Filter life timer
    m. External on/off input
    n. Wi-Fi compatible
    o. Auto fan operation
    p. Leak detection logic

D. Fan Assembly

1. The unit shall have a single, direct-drive turbo fan made of high strength ABS HT-700 polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
4. The fan motor shall include thermal, overcurrent and low RPM protection.
5. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
6. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of four pre-programed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
7. A field setting shall be provided to vary air throw pattern to compensate for high ceiling installations.
8. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Super high, Power Cool, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, Super high and Auto.
10. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.

E. Filter Assembly

1. The return air inlet shall have a factory supplied removable, washable filter.

2. The filter access shall be from the bottom of the unit without the need for tools.
3. The nominal 3'x3' cabinet unit shall have provision for an optional auto-elevating grille kit designed to provide motorized ascent/descent of the return air grille/pre filter assembly.
    a. The ascent/descent of the return air grille shall be up to a distance of 14-3/4 feet allowing access to remove and clean the filter.
    b. The auto-elevating grille shall have a control algorithm to accept up, down and stop control commands from the controller.
    c. The auto-elevating grille shall have a control to stop the descent automatically if a contact is made with any obstacle.

F. Coil Assembly

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum one or two row coil, 18-19 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
5. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit.
6. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 550 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

G. Microprocessor Control

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted and shielded communication cable.
3. The unit controls shall operate the indoor unit using one of the five operating modes:
    a. Auto changeover (Heat Recovery System only)
    b. Heating
    c. Cooling
    d. Dry
    e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
7. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
8. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.

H. Electrical

1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

I. Controls

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.

J. Seismic Installations

1. Provide with submittal: 1) OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. 2) Equipment installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

K. Warranty

1. Please refer to the respective outdoor unit for applicable warranty

2.3 CEILING CASSETTE – 1 WAY

A. General:

1. Unit shall be manufactured by LG.
2. Unit shall be designed for indoor application.
3. 4.0 Unit shall be designed to mount recessed in the ceiling and has a surface mounted grille with air inlet and outlet.

B. Casing/Panel

1. Unit case shall be manufactured using galvanized steel plate.
2. The unit shall be provided with an off-white Acrylonitrile Butadiene Styrene (ABS) polymeric resin grille.
3. The grille shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
4. Unit shall be provided with metal ears designed to support the unit weight on four corners.
5. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.

C. Cabinet Assembly:

1. Unit shall have one supply air outlet and one return air inlet.
2. The supply air outlet shall be through a single directional slot diffuser with oscillating motorized guide vane designed to change the airflow direction.
3. The grille shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes.
4. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.
5. Unit shall be equipped with factory installed temperature thermistors for:
   a. Return air
   b. Refrigerant entering coil
   c. Refrigerant leaving coil
6. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
7. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit main processor.
8. The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
9. Unit shall have the following functions as standard:
   a. Self-diagnostic function

b. Auto addressing
c. Auto restart function
d. Auto changeover function (Heat Recovery system only)
e. Auto operation function
f. Child lock function
g. Forced operation
h. Dual thermistor control
i. Sleep mode
j. Dual set point control
k. Filter life timer
l. Power consumption data
m. External on/off input

D. Fan Assembly:

1. The unit shall have a single, direct driven, crossflow tangential Sirocco fan made of high strength ABS GP-2305 polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
4. Fan speed shall be controlled using microprocessor based digitally controlled algorithm that provides a minimum of four pre-programed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
5. The fan motor shall include thermal overload and low RPM protection.
6. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, super high, Power Cool, and Auto. The fan motor shall include thermal overload and low RPM protection.
7. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, super high, Power Cool, and Auto.
8. In heating mode, the indoor fan shall have the following settings: Low, Med, High, super high and Auto.

E. Filter Assembly:

1. The return air inlet shall have a factory supplied removable, washable filter
2. The filter access shall be from the bottom of the unit without the need for tools.

F. Coil Assembly:

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum two row coil, 21 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
5. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit.
6. Unit shall have a 1.0” ID factory insulated drain hose to handle condensate.
7. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
8. Unit shall have provision of 45° flare refrigerant pipe connections.
9. The coil shall be factory pressure tested at a minimum of 550 psig.
10. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

G. Microprocessor Control:

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable (RS485).
3. The unit controls shall operate the indoor unit using one of the five operating modes:
   a. Auto changeover (Heat Recovery System only)
   b. Heating
   c. Cooling
   d. Dry
   e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
7. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
8. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation

H. Electrical:

1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

I. Controls:

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3. CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
B. Piping installation requirements are specified in division 23 mechanical & division 22 plumbing specifications. Drawings indicate general arrangement of piping, fittings and specialties.
C. Duct installation and connection requirements are specified in Division 23 of this document.
D. Electrical installation requirements are specified in Division 26 of this document.

3.4. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5. START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6. DEMONSTRATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 236700 – 6 TO 42 TONS CAPACITY VRF SYSTEM OUTDOOR UNITS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Outdoor Units, also called condensing unit or air cooled condensing units, consisting of condenser fans, heat rejection coils, variable speed compressors, and controls housed in a cabinet. Units are designed to reject heat from hot refrigerant by circulating ambient air over finned coils which contain the hot refrigerant. Fluids is a refrigerant. Electric Heat may also be offered in unit for low ambient air conditions for operation. Outdoor Condensing Units are used in both heating and/or cooling applications.

1.2 RELATED SECTIONS

A. Division 23 Mechanical Specifications

1.3 REFERENCES

A. United Electric Company designs and builds its Magic Aire products to comply and perform to the following standards as applies:

1. Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation.
2. AMCA 210, ASHRAE 51: Airflow
3. ARI 410: Coil Capacity – Hydronic
4. ARI 210: Coil Capacity – DX
5. ANSI/UL – 1995: Safety Agency Listing of base or standard equipment is ETL, ETL file #491893
6. Material Specifications Standards:
   a. ASTM A525, A527: Sheet Metal
   b. ASTM B68, B75, B88, B251: Copper Tubing per
   c. ASTM B209: Aluminum
7. Major Components Standards:
   a. NEMA per UL/CSA: Motors
   b. UL/CSA: Wire
   c. UL/CSA: Electrical
   d. ASHRAE 52: Filters per UL,
   e. UL 181, UL 723 (25/50), ASTM E-84: Fiberglass Insulation
   f. ASTM B117:Paint per
   g. UL-1995: Electric Heater, factory installed assembly (HB)
   h. UL-1996: Electric Heater, field-installed accessory (BM,BV)

1.4 SUBMITTALS

A. Confirm product application requirements in sufficient detail to specify product as it is to be manufactured.

1.5 QUALITY ASSURANCE

A. Coil(s) shall be factory tested for leakage at minimum of 500 psig air pressure under water.

B. Valve Package shall be factory tested to withstand 50 psi pressure degradation with no losses.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Inspection: Inspect all items for transit damage or any indication of re-pack. Follow manufacturer directions for filing freight claims.

C. Storage: Store materials in a dry, sheltered area, protected from damage and in accordance with manufacturer's instructions.

D. Handling: Handle and lift products in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturers shall be the following:

1. L.G.
2. Approved Equal.

2.2 MULTI V™ HEAT RECOVERY AND HEAT PUMP SYSTEM(S) – (6 TO 42 TONS NOMINAL)

A. Product Design

1. LG Multi V 5 heating and cooling system shall be an air cooled system allowing user to configure in the field a heat pump or a heat recovery system consisting of one to three outdoor unit modules, conjoined to make a 6-42 ton single refrigerant circuit.
   a. Heat recovery systems, employing three pipes, shall be connected to Heat recovery (heat recovery) unit(s) and indoor unit(s). Multi-port heat recovery units shall allow simultaneous heating and cooling of individual zone(s) at various capacities as required to satisfy their zone requirements.
   b. Heat pump systems shall require two pipes, simultaneous heating and cooling shall not be supported. The heat recovery system shall consist of three pipes, liquid, suction and hot gas pipes. Heat recovery systems operating at 0°F that cannot deliver single phase superheated refrigerant vapor at a minimum of 162°F while operating in the heating mode shall not be acceptable.
2. All three-phase VRF heat pump and heat recovery outdoor units shall be from the same product development generation. Mixing of outdoor units from different development generations is not acceptable.

B. Operating Conditions

1. Outdoor Unit shall be capable of continuous compressor operation between the following operating ambient air conditions, operation outside of these conditions are possible and may involve non-continuous operations.
2. Operating Ambient Air Conditions:
   a. Cooling: 5°F DB to 122°F DB
   b. Heating: -22°F WB to 61°F WB
   c. Cooling Based (ODU reversing valve in cooling position) Synchronous: 14°F DB to 81°F DB (Heat Recovery Operation Only)

d. Heating Based (ODU reversing valve in heating position) Synchronous: 14°F WB to 61°F WB (Heat Recovery Operation Only)

C. Electrical

1. All air source heat pump and heat recovery frame(s) shall be designed and electrically protected to maintain stable continuous compressor operation when provided with <208-230/60/3> power with the following specifications:
   a. <208-230/60/3>
      1) Voltage fluctuation of ± 10%
      2) Voltage imbalance of up to two percent;
      3) Power surge of up to 5kA RMS Symmetrical.

D. General Features

1. The air-conditioning system shall use R410A refrigerant.
2. Each system shall consist of one, two or three air source outdoor unit modules conjoined together in the field to result in the capacity specified elsewhere in these documents.
3. Dual and triple frame configurations shall be field piped together using manufacturer's designed and supplied Y-branch kits and field provided interconnecting pipe to form a common refrigerant circuit.
4. System shall have following frame configurations vs. capacity.
   a. 6 to 20 ton units shall be a single frame only.
   b. 22 to 34 ton units shall be dual frame only.
   c. 36 to 42 ton heat recovery units shall be triple frame only
5. System shall employ self-diagnostics function to identify any malfunctions and provide type and location of malfunctions via fault alarms.

6. **Field Provided Refrigerant Piping:**

   a. The refrigerant piping system shall be constructed using field provided ACR copper rated for the use with refrigerant R410A, de-hydrated pipe field engineered and assembled with manufacturer supplied Heat recovery unit(s) and Y- branches, as may be required, connected to multiple (ducted, non-ducted or mixed combination) indoor units to effectively and efficiently control the heat pump operation or simultaneous heating and cooling operation of the heat recovery VRF system. Other pipe materials, if used, shall perform, at a minimum, as well as that specified above, shall not have any adverse reactions, for example galvanic corrosion or branch to branch differential pressure drop, with any other components or materials also in use in the system and shall be installed per manufacturer's instructions.
   b. The unit shall be shipped from the factory fully assembled including internal refrigerant piping, inverter driven compressor(s), controls, temperature sensor, humidity sensor, contacts, relay(s), fans, power and communications wiring as necessary to perform both Heat Pump and Heat Recovery operations.
   c. Each outdoor unit refrigeration circuit shall include, but not limited to, the following components:
      1) Refrigerant strainer(s)
      2) Check valve(s)
      3) Inverter driven, medium pressure vapor injection, high pressure shell compressors
      4) Liquid refrigerant cooled inverter PCB
      5) Oil separator(s)
      6) Accumulator /controlled volume receiver(s)
      7) 4-way reversing valve(s)
         a) Vapor injection valve(s)
      8) Variable path heat exchanger control valve(s)
      9) Oil balancing control

10) Oil Level sensor(s)
11) Electronic expansion valve(s)
    a) Sub-cooler (s)
    b) Vapor Injection Valve(s)
12) High and low side Schrader valve service ports with caps
    a) Service valves

7. **Field Insulation:**

    a. All refrigerant pipe, y-branches, elbows and valves shall be individually insulated with no air gaps. Insulation heat transfer resistance shall not be less than the minimum called for by the local building code, local energy code or as a minimum per manufacture installation requirements. In no case shall the insulation be installed in a compressed state at any point in the system.
        1) All joints shall be glued and sealed per insulation manufactures instructions to make a vapor tight assembly.

8. **Microprocessor:**

    a. Factory installed microprocessor controls in the outdoor unit(s), heat recovery unit(s), and indoor unit(s) shall perform functions to optimize the operation of the VRF system and communicate in a daisy chain configuration between outdoor unit and heat recovery unit(s) and indoor unit(s) via RS485 (shielded twisted wire pair) network. Control devices shall also be available to control other building systems as required from the VRF control system. DIO/AIO capabilities shall be available as well as a central controller to perform operation changes, schedules and other duties as required by this specification. Addition of separate building control system shall not be required. Other control devices and sequences shall be as specified in other sections of this project specification.

9. **Inverter PCB Cooling:**

    a. Cooling of the inverter PCB shall be conducted by way of high pressure, sub-cooled liquid refrigerant via heat exchanger attached to the inverter PCB. The full capacity flow of refrigerant shall pass though the heat exchangers to maximize the cooling effect of the PCBs and to aid in the evaporation process and capacity of the outdoor coil during the heating mode. The recovered heat of the PCBs must be used to enhance the overall heating process, other uses or dissipation of heat to ambient shall not be permitted.

10. **Compressor Control:**

    a. Fuzzy control logic shall establish and maintain target evaporating temperature (Te) in cooling mode and condensing temperature (Tc) in heating mode by Fuzzy control logic to ensure the stable system performance.

11. **Initial Test Run (ITR) (Heating or Cooling) / Fault Detection Diagnosis (FDD) Code:**

    a. This control mode shall monitor and display positive or negative results of system initial startup and commissioning. Heating or Cooling ITR mode will be automatically selected. It shall monitor and provide performance metrics for the following, but not be limited to, refrigerant charge validation, auto-charge operation verification, refrigerant cycle stability, connection ratios, indoor unit status, error status, and number of indoor units connected. This commissioning specific control mode shall not replace the system error monitoring control system during normal operation.

12. **BMS Integration:**

a. The VRF system shall be able to integrate with Building Management Systems via BACnet™ IP gateway. This gateway converts between BACnet™ IP or Modbus TCP protocol, and RS-485 LGAP (LG Aircon protocol) allowing third party control and monitoring of the LG A/C system, or LonWorks™ gateways. See controls specification for points list.

13. **Wi-Fi Communication:**

    a. The outdoor unit microprocessor shall be capable of being monitored via an optional Wi Fi wireless communications dongle or embedded Wi Fi transmitter. Wi-Fi shall allow service or maintenance personal access to the complete operating system, via LGMV mobile, without need of tools other than smart phone or tablet. Active live system review, collection of all system data for a field determined duration presented in a .csv file format or collection of all operating conditions, including all indoor units, valves, sensors, compressor speeds, refrigerant pressures, etc., by snapshot of conditions and placing that snapshot into a power point slide to be reviewed at another time. Systems that require computers, hard wire only connection or other devices to collect, review or record operating conditions shall not be allowed.

14. **Indoor Unit Connectivity:**

    a. The system shall be designed to accept connection up to <64> indoor units of various configuration and capacity, depending on the capacity of the system.

15. **Power and Communication Interruption:**

    a. The system shall be capable of performing continuous operation when an individual or several indoor units are being serviced; communication wire cut or power to indoor unit is disconnected from power for a minimum of a 24 hour period. Systems that alarm and/or shut down because of a lack of power to any number of indoor units shall not be acceptable.

16. **Connection Ratios:**

    a. The maximum allowable system combination ratio for all VRF systems shall be 130% and the minimum combination ratio shall be 50%.

17. **Comfort Cooling Mode:**

    a. Comfort cooling shall be initiated via a field setting at the outdoor unit during commissioning or anytime thereafter. Comfort cooling shall allow user to select all or some of the indoor units of a system to automatically modify each of the indoor unit's superheat target set point based on the impending total cooling load of on the indoor unit, the rate of change of the zone temperature relative to set point and optionally, if specified, the rate of change of the zone humidity level.
    b. The outdoor unit shall be provided with a factory installed fusible plug or rupture disc. The fusible plug connection shall be threaded for easy connection with a field provided vent pipe to safely discharge the system's refrigerant charge away from the outdoor unit if a building fire causes an extreme pressure condition in the outdoor unit refrigerant circuit employ for safety a threaded fusible plug.

18. **Refrigerant Flow Control**

    a. An active refrigerant -in-circulation control system consisting of a refrigerant storage container, interconnecting refrigerant piping control valves, pressure transducers, microprocessor control, and software to continuously monitor necessary refrigeration cycle operating parameters to maintain stable cycle operation between minus (-)22°F and 122°F ambient conditions. The refrigerant system operating conditions shall be checked by the

algorithm at three minute intervals and if needed automatically and dynamically remove and store refrigerant to the storage tank or inject refrigerant from the tank into the refrigerant circuit.

1) The algorithm shall adjust refrigerant charge automatically:
    a) As the outdoor air temperature changes;
    b) System mode of operation changes;
    c) The path of refrigerant flow through the outdoor coil is modified;
    d) The system's target suction and head pressure control values are adjusted.

b. Subcooler: The VRF outdoor unit shall include a factory provided and mounted sub-cooler assembly consisting of a shell and tube-type sub-cooling heat exchanger and EEV providing refrigerant sub-cooling modulation control by fuzzy logic of EEV and by mode of operation to provide capacity and efficiency as required. Brazed plate heat exchangers shall not be allowed for this function.

c. Advanced Smart Load Control: The air source unit shall be provided with Smart Load Control (SLC) enhanced energy saving algorithm that reduces compressor lift during off-peak operation to further reduce system energy consumption when weather and load conditions permit.

1) The SLC algorithm shall be monitoring in real time, the rate of change of the outdoor ambient air temperature, either the outdoor ambient air relative humidity or the indoor air relative humidity [field selectable], and the rate of change of the building load.
2) The SLC algorithm shall foresee pending changes in the building load, outdoor temperature and humidity (or indoor humidity) and proactively reset head and/or suction pressure targets in anticipation of the reduction/increase in building load.
3) The SLC algorithm shall provide no fewer than three (3) field selection options to maximize the control of the VRF system operation during morning warm-up or cool-down following night-setback reset. The selection shall be set by the commissioning agent (or at any other time thereafter). Selectable algorithm choices include:
    a) Maximize energy savings
    b) Balance the rate of temperature change with energy consumed.
    c) Quickly cool/heat the building.

19. **Refrigerant Volume Management**

a. Active Refrigerant Charge

1) The VRF system shall be able to operate at any and all published conditions year round in cooling or heating mode without the need of adding or removing refrigerant from the system.
2) The air source unit shall be provided with an isolated vessel, interconnecting piping, valves and sensors to store refrigerant and actively pass refrigerant to (or from) the refrigerant circuit in real time as necessary to maintain stable refrigeration cycle operation.
3) The air source unit microprocessor shall be provided with an algorithm that monitors the VRF system head pressure, suction pressure, subcooling, superheat, compressor speed, high and low side temperatures and the load on the system at three minute intervals and if needed, automatically and dynamically remove and store refrigerant to the storage tank or inject refrigerant from the tank into the refrigerant circuit.

b. Manual Seasonal Refrigerant Charge Adjustments

(Applicable for VRF systems without Active Refrigerant Charge)

1) Alternates: Systems that **CANNOT** passively and automatically modify the active refrigerant charge using the method(s) stated in the section *Active Refrigerant Charge* shall clearly state so in bold capital letters in the proposal that this feature is not included.
2) VRF systems that cannot perform active refrigerant control may submit their proposal as an Alternate. However all Alternate proposals must BUT include as part of the

equipment price the cost of to provide bi-annual refrigerant charging services for 15 years. Service shall be performed by the factory authorized agent only. Service shall include refrigerant, parts, labor, truck and/or trip charges, and any miscellaneous fees necessary to analyze the current state of the system and perform the refrigerant charge adjustment. Service must occur one month before the winter season and one month before the summer season.

3) If the VRF system requires a charge adjustment more frequently to maintain stable operation, the VRF manufacturer shall provide additional services at no additional charge.
4) The 15 year period shall begin on the date the equipment is commissioned or the date the building occupancy permit was issued for the area(s) served by the system – whichever date is later.
5) This service shall be underwritten, warranted, and administered by the VRF equipment manufacturer – not the local distributor or applied representative.
6) The selected service provider shall be mutually agreeable between the building owner (or owners agent) and must be licensed, insured, and trained to work on the VRF system. No third party service (subcontracted service) providers will be acceptable.
7) If the service provider is not an employee of the VRF manufacturer, the service provider shall be reimbursed for services rendered directly from the manufacturer. Labor rate for services shall be paid at the prevailing union wage rate in place at the time of service.

20. VRF Systems with Onboard Alternate Operating Mode Selection Capability
    a. All VRF systems equipped with field selectable Alternate Operating Modes via DIP Switch or other means, for example but not limited to, High Heat, High Ambient Cooling, High Sensible, or Enhanced Efficiency selections. Performance using the proposed field selected Alternate Operating Mode shall be tested using AHRI Standard 1230 and published in the AHRI Directory.
    b. Acceptable Alternate Operating Modes must ship with all models of the VRF product offering and must be factory embedded. Custom factory or field modifications to factory provided algorithms created to meet scheduled requirements are not acceptable.
    c. Provide a copy of instructions required to set the Alternate Operation Mode with the initial submittal.
    d. For systems that provide field selectable Alternate Operating Modes, ALL technical data provided in the submittal data sheets showing product rated condition performance data, must also provide separate data sheets that show product performance data at each of the field selectable Alternate Operating Modes available. Capacity, power input, and acoustic performance data for each mode offered shall be reported separately. Mixing of ODU, IDU, or VRF system performance capability operating in one mode with for example the power consumption, sound power rating, or electrical requirements of the same system operating in another mode is not acceptable.

E. Field Supplied Refrigerant Piping Design Parameters

1. The outdoor unit shall be capable of operating at an elevation difference of up to 360 feet above or below the lowest or highest indoor unit respectively without the requirement of field installed subcooler or other forms of performance enhancing booster devices.
2. The outdoor unit shall be capable of operating with up to 3280 equivalent length feet of interconnecting liquid line refrigerant pipe in the network.
3. The outdoor unit shall be capable of operating with up to 656 actual feet or 738 equivalent length feet of liquid line refrigerant pipe spanning between outdoor unit and farthest indoor unit.
4. The piping system shall be designed with pipe expansion and contraction possibilities in mind. Required expansion devices shall be field designed, supplied and installed based on proper evaluation of the proposed piping design. In addition to these requirements, the piping system installation must conform to the VRF equipment manufacturer's published guidelines.

5. The installation of pipe hangers, supports, insulation, and in general the methods chosen to attach the pipe system to the structure must allow for expansion and contraction of the piping system and shall not interfere with that movement.
6. The elevation difference between indoor units on <heat pump systems> shall be 131 feet.
7. The acceptable elevation difference between two series connected heat recovery units shall be 16 feet.

F. Defrost Operations

1. The outdoor unit(s) shall be provided with a minimum of 4 independent field adjustable defrost cycle algorithms to maximize the effectiveness of the defrost cycle to the local weather conditions. Intelligent Defrost shall melt accumulated frost, snow and ice from the outdoor unit heat exchanger. The defrost cycle length and sequence shall be based on outdoor ambient temperatures, outdoor unit heat exchanger temperature, and various differential pressure variables. Intelligent Heating Mode, when outdoor unit humidistat is engaged, shall extend the normal heating sequences by adjusting the outdoor unit coil target temperature to be above the ambient dew point temperature delaying the need for defrost operations, so long as heating demand is being met.
2. Smart Heating**:** This feature shall be capable of eliminating several defrost actions per day based on outdoor air temperature and humidity conditions. Smart heating shall extend the heating operation cycle by delaying the frost formation on the outdoor coil by adjusting the surface temperature to keep it above the current outdoor ambient dew point. The algorithm shall delay while maintaining indoor space temperature.
3. Defrost Mode Selection: The outdoor unit shall be provided with a minimum of three field selectable defrost operation modes: Normal, Fast, or Forced.
    a. Normal Defrost: Operation intended for use in areas of the country that experience adverse winter weather with periods of heavy winter precipitation and extremely low temperatures. This strategy shall maximize the systems heating performance and maintain operational efficiency. When the ambient temperature is either: a) above 32°F or b) below 32°F with the humidity level below 60% RH, Intelligent Defrost shall continue heating regardless of ice build-up on the coil until the quality of the heated air (i.e. discharge air temperature) decreases. At temperatures below 4°F, a defrost cycle shall occur every two hours to optimize system heating efficiency.
    b. Fast Defrost: Operation intended for use in areas of the country with mild winter temperatures and light to moderate humidity levels. The strategy minimizes defrost cycle frequency allowing frozen precipitation to build longer in between cycles. Minimum time between defrost cycles shall be 20 minutes. Intelligent Defrost shall choose between split coil/frame and full system methods based on current weather conditions to minimize energy consumption and maximize heating cycle time.
    c. Forced Defrost: Operation shall be available for the service provider to test defrost operations at any weather condition and to manually clear frozen water from the outdoor coil surfaces.

4. Defrost Method Selection: The outdoor unit shall be provided with two field selectable defrost operation methods: Split Coil/Frame and Full System. Split Coil/Frame option provides continuous heating of the occupied space during defrost operation.
    a. Split Coil/Frame method shall be available when Normal Defrost mode is selected. Split Coil method shall be available on all Heat Pump and Heat recovery single-frame VRF systems. Split Frame defrost shall be available on all Heat Pump and Heat recovery multi-frame outdoor units.
    b. Split Coil method shall remove ice from the bottom half of the outdoor unit coil first for a maximum time of six minutes, then the top half for a maximum of six minutes. Next the bottom coil shall be heated again for an additional three minutes to remove any frozen water that may have dripped onto the lower coil during the top coil defrost operation.

c. When Split Coil/Frame method is selected, a Full System defrost shall occur every 1-9 (field selectable) defrost cycles to assure 100% of the frozen precipitation has been removed to maintain efficient performance.
d. Full System method shall be available as a field selectable option. All outdoor units located in areas of the country where large volumes of frozen precipitation are common, the commissioning agent shall be able to select the Full System only defrost method.

5. Indoor Unit Fan Operation During Defrost

a. During partial defrost operation indoor units operating in cooling or dry mode shall continue normal operation.
b. During partial defrost operation, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the defrost cycle.
c. During full system defrost operation indoor unit fans will cycle off and remain off during the remainder of the defrost cycle.

G. Oil Management

1. The system shall utilize a high pressure oil return system to ensure a consistent film of oil on all moving compressor parts at all points of operation. Oil is returned to compressor through a separate high pressure oil injection pipe directly into the oil sump. Oil returned to the compressor via the suction port of the compressor shall not be allowed.
2. Each compressor shall be provided with a high efficiency independent centrifugal cyclone type oil separator, designed to extract oil from the oil/refrigerant gas stream leaving the compressor.
3. The system shall have an oil level sensor in the compressor to provide direct oil level sensing data to the main controller. The sensor shall provide data to main outdoor unit PCB to start oil return mode and balance oil levels between multiple compressors.
4. The system shall only initiate an oil return cycle if the sensed oil level is below oil level target values as determined by the microprocessor. The system shall display an error if the oil sensor signals low oil level for a period of 130 minutes or longer.
5. A default oil return algorithm shall automatically initiate the oil return mode if the system detects a failure of the oil sump sensor. A fault code shall be reported by the system.
6. Timed oil return operations or systems that do not directly monitor compressor oil level shall not be permitted.
7. Indoor Unit Fan Operation during Oil Return Cycle
   a. During oil return cycle indoor units operating in cooling or dry mode shall continue normal operation.
   b. During oil return, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the oil return cycle.
   c. During oil return cycle indoor unit fans will cycle off and remain off during oil return cycle while operating in all modes.

H. Fan and Motor Assembly

1. 6 ton frames shall be equipped with one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a vertical air discharge.
2. 8 to 20 ton frames shall be equipped with two direct drive variable speed propeller fan(s) with BLDC motor(s) with a vertical air discharge.
3. The fan(s) blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material and incorporate biomimetic technology to enhance fan performance and reduce fan generated noise.
4. The fan(s) motor shall be equipped with permanently lubricated bearings.

5. The fan motor shall be variable speed with an operating speed range of 0-1150 RPM cooling mode and 0-1150 RPM heating mode.
6. The fan shall have a guard to help prevent contact with moving parts.
7. The cabinet shall have option to redirect the discharge air direction from vertical to horizontal with the addition of optional factory provided air guides.
8. The fan controller shall have a DIP switch setting to raise external static pressure of the fan up to 0.32 inch of W.C. to accommodate ducted installations.
9. The fan control shall have a function setting to remove excess snow automatically.
10. The fan control shall have a function setting to remove access dust and light debris from the outdoor unit and coil.

I. Cabinet

1. Outdoor unit cabinet shall be made of 20 gauge galvanized steel with a weather and corrosion resistant enamel finish. Outdoor unit cabinet finish shall be tested in accordance with ASTM B-117 salt spray surface scratch test (SST) procedure for a minimum of 1000 hours.
2. Cabinet weights and foot prints shall vary between 430 lbs., 7.61 sq. ft. (1.27 sq. ft. per ton), for 6 ton cabinet to 666 lbs., 10.14 sq. ft. (.51 sq. ft. per ton), for 20 ton cabinet for single cabinet configurations. The front panels of the outdoor units shall be removable type for access to internal components.
3. A smaller service access panel, not larger than 7” x 7” and secured by a maximum of (2) screws, shall be provided to access the following:
   a. Service tool connection
   b. DIP switches
   c. Auto addressing
   d. Error codes
   e. Main microprocessor
   f. Inverter PCB
4. The cabinet shall have piping knockouts to allow refrigerant piping to be connected at the front, right side, or through the bottom of the unit.
5. The cabinet shall have a factory installed coil guard.

J. Outdoor Unit Coil

1. Outdoor unit coil shall be designed, built and provided by the VRF outdoor unit manufacturer.
2. The outdoor unit coil for each cabinet shall have lanced aluminum fins with a maximum fin spacing of no more than 17 Fins per Inch (FPI). All the outdoor unit coils shall be a 2 or 3 rows consisting of staggered tubes for efficient air flow across the heat exchanger
3. Outdoor unit coil shall be comprised of aluminum fins mechanically bonded to copper tubing with inner surfaces having a riffling treatment to expand the total surface of the tube interior
4. The aluminum fin heat transfer surfaces shall have factory applied corrosion resistant Black Fin coating. The copper tubes shall have inner riffling to expand the total surface of the tube interior.
   a. ISO 21207 Salt Spray Test Method B – 1500 hours
   b. ASTM B-117 Acid Salt Test – 900 hours
   c. The Black Fin coating shall be certified by Underwriters Laboratories and per ISO 21207. The above conditions shall establish the minimum allowable performance which all alternates must comply.
5. Variable Path Heat Exchanger: System shall have a variable flow and path outdoor heat exchanger function to vary the refrigerant flow and volume and path. Control of the variable path circuits shall be based on system operating mode and operating conditions as targeted to manage the coil heat transfer capacity and efficiency. The variable path heat exchanger technology shall be provided to maintain stable refrigeration cycle operation during mild weather conditions and maintain a robust hot vapor temperature system head pressure that delivers “gas-furnace leaving air temperature” from the indoor unit at sub-zero outdoor air

temperature down to minus (-) 22°F.The outdoor unit coil, all indoor units and pipe network shall be field tested to a minimum pressure of 550 psig.

K. Compressor(s)

1. Compressor shall be designed and assembled by the VRF manufacturer specifically for use in the air source VRF product line. Third party manufactured, branded, or designed to the VRF system's OEM specifications by a third party manufacturer shall not be acceptable.
2. Compressor shall be a hermetic, high-side shell (HSS), commercial grade, compliant scroll direct-drive design.
    a. Compressor Design: The compressor design shall be of the high pressure shell scroll type where the internal pressure below the suction valves of the compressor shall be at the same high pressure and high temperature. The motor shall be cooled by high pressure gas at temperatures above saturation conditions and minimize the mixing of refrigerant liquid with oil in the sump. The system shall employ a high pressure oil return method returning recovered oil from the oil separator directly into the oil sump of the compressor; oil shall not be allowed to return via the suction line. Bearing surfaces are continually coated with oil. The compressor shall employ an Aero-bearing constructed with high lubricity materials increasing operation time in case of low sump oil level. Compressor shall have a nominal operating range from 12Hz to 150 Hz.
3. The fixed and oscillating compressor scroll components shall be made of high grade (GC25) or denser steel material. All scrolls shall be heat treated and tempered.
4. The oscillating scroll shall be finely machined and polished. PVE refrigerant oil shall be used as the sole liquid used to maintain a seal between the high and low sides of the compression chamber. Compressors that requires the use of any type of mechanical or wearable sealant material between the moving surfaces of the compression chamber is NOT ACCEPTABLE.
5. Vapor Injection: System shall have a medium pressure gas vapor injection function employed in the heating and cooling modes to increase system capacity when the outdoor ambient temperatures are low and lower compressor lift when temperatures are high. The compressor vapor injection flow amount shall be controlled by the vapor injection sub-cooling algorithm reset by discharge gas temperatures of the compressor.
6. Bearing surfaces shall be coated with Teflon® equal. Bearings shall be lubricated using a constant flow of PVE refrigerant oil to the bearing surfaces The film of oil separating the crankshaft journals and bearing surfaces shall be consistent at all times the crankshaft is in motion and shall be maintained irrelevant of crankshaft rotational speed.
7. An internal, integrated, mechanically driven gear pump shall draw oil from the compressor sump reservoir, pressurize the oil and inject the oil directly to the crankshaft journals maintaining a consistent film of oil between all moving parts. Auxiliary, indirect, or electronically driven pumps are not acceptable.
8. The viscosity property of the PVE oil in the compressor sump shall be maintained irrelevant or compressor operation and the surrounding ambient temperature.
    a. The compressor shall be equipped with an external thermally protected electric crankcase heater that is automatically activated only when the ambient temperature is below freezing and the compressor is not running to maintain the temperature of the oil in the sump above the refrigerant boiling point.
    b. During stable operation, irrelevant of ambient air temperature outside the water source unit, the temperature of refrigerant vapor in contact with the surface of the oil in the compressor sump shall be maintained above 140°F to prevent foaming and to eliminate refrigerant from mixing with the oil degrading the viscosity of the oil in the sump.
9. The compressor motor shall be designed to operate at high temperatures.
    a. The motor winding insulation shall be designed to operate continuously at a minimum temperature of 180°F without deterioration.
    b. The motor cooling system shall be designed to maintain acceptable operational temperature at all times and in all conditions using high pressure, hot refrigerant vapor as motor coolant.
10. Inverter Compressor Controller(s)

a. Each compressor shall be equipped with a dedicated inverter compressor drive. The control of multiple compressors using a single drive is not acceptable.
b. The inverter drive shall vary the speed of the compressor crankshaft between zero (0) Hz and 140 Hz.
c. The inverter driver controller shall be matched with the physical properties of the compressor. The drive shall be manufactured by the VRF air source unit manufacturer. The inverter drive and matching compressor shall have been thoroughly tested as a matched pair. The inverter drive shall be programmed to avoid operating the compressor at any speed that results in harmonic vibration, nuisance noise, or mechanical damage to either the driver or the compressor with power provided that is within the tolerance specification.
d. The compressor inverter drive assembly and software must be designed, manufactured, and supplied by the VRF product manufacturer. Third party branded inverter driver hardware and/or driver software or inverter driver hardware and/or software provided by a third party manufacturer to meet OEM specifications of the VRF water source manufacturer will not acceptable.
e. All inverter drive hardware or software manufactured in, is a product of, or sourced from China, or using a broker or third party provider as an intermediary that obtains the product from CHINA shall not be acceptable.

11. Compressor(s)
    a. Each 6, 8, 10 ton frames shall be equipped with a single hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressor.
    b. 12, 14, 16, 18 and 20 ton frames shall be equipped with dual hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressors.
    c. Each inverter driven, HSS scroll compressor shall be capable of operating from 12 Hz up to 150 Hz in any and all modes (cooling, heating or simultaneous modes).
    d. The compressor shall be designed for a separate port for oil to be directly returned to the compressor oil sump.
    e. The compressor bearing(s) shall have Teflon™ coating and shall be an aero type design using High lubricity materials.
    f. The compressor(s) shall be protected with:
        1) High Pressure switch
        2) Over-current /under current protection
        3) Oil sump sensor
        4) Phase failure
        5) Phase reversal
        6) Compressor shall be capable of receiving injection of medium pressure gas at a point in the compression cycle where such injection shall allow a greater mass flow of refrigerant at lower outdoor ambient and achieving a higher heating capability. The VRF outdoor unit shall have published performance data for heating mode operation down to -22°F on both heat pump and heat recovery systems.
    g. Standard, non-inverter driven compressors shall not be permitted nor shall a compressor without vapor injection or direct sump oil return capabilities.

L. Operational Sound Levels

1. The compressor(s) shall be mounted on rubber isolation grommets. Compressor shall ship with removable clamps that secure the compressor in place while transported. The installing contractor shall remove and discard (or optionally adjust the clamps to allow the isolator to properly function) the clamps prior to commissioning the water source unit.
2. Each single frame outdoor unit shall be rated with an operational sound pressure level not to exceed as listed on below chart when tested in an anechoic chamber under ISO 3745 standard at the highest field selectable heating operating modes available. Such documentation shall be presented in all submittals, manufactures who elect to rate their equipment at other than tested in an anechoic chamber under ISO 3745 standard at the highest field selectable heating operating modes available and the highest field selectable conditions shall not be allowed.

3. A field setting shall be available to program the outdoor unit to reduce sound levels at night, when desired, to a selectable level while still able to meet building load requirement. This mode is available in both cooling and heating modes.

M. Sensors

1. Each outdoor unit module shall have:
   a. Suction temperature sensor
   b. Discharge temperature sensor
   c. Oil level sensor
   d. High Pressure sensor
   e. Low Pressure sensor
   f. Outdoor temperature sensor
   g. Outdoor humidity sensor
   h. Outdoor unit heat exchanger temperature sensors

N. Wind Load Installations for Outdoor Units

1. Provide Florida wind Load Installation Drawings that meet the requirements of the 2017 Florida Building Code, 6th Edition and ASCE Standard 7-2010 with submittal.

O. Seismic Installations

1. Provide with submittal: 1) OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. 2) Equipment installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

P. Warranty

1. Limited Warranty Period
   a. STANDARD ONE-YEAR PARTS WARRANTY FOR A QUALIFIED SYSTEM - The Part(s) of a qualified System, including the compressor, are warranted for a period (the “Standard Parts Warranty Period”) ending on the earlier to occur of one (1) year after the date of original installation, or eighteen (18) months from the date of manufacture.
   b. ADDITIONAL SIX (6) YEAR COMPRESSOR PART WARRANTY - The Compressor is warranted for an additional six (6) year period after the end of the applicable Standard Part Warranty Period (the “Compressor Warranty Period”).

PART 3- EXECUTION

3.1. EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3. CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
B. Piping installation requirements are specified in division 23 mechanical & division 22 plumbing specifications. Drawings indicate general arrangement of piping, fittings and specialties.
C. Duct installation and connection requirements are specified in Division 23 of this document.
D. Electrical installation requirements are specified in Division 26 of this document.

3.4. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5. START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6. DEMONSTRATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION

DIVISION 23-MECHANICAL
237406 - PACKAGED ROOFTOP VENTILATORS WITH ENERGY RECOVERY WHEEL/HEATING/COOLING

PART 1 - GENERAL

1.1. SUMMARY

A. This section includes units with integral cooling for outdoor installation. Integral Energy Recovery device shall be a rotary air-to-air total enthalpy wheel. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air with Recirculation. Each unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in Section 2 of this specification.

B. Related Sections include the following:

1. Project Manual-Divisions 1 through 22: Scope of Work
2. Project Manual-Divisions 1 through 22: General Provisions
3. Project Manual-Division 23: Insulation
4. Project Manual-Division 22: Plumbing
5. Project Manual-Division 23: Automatic Temperature Control Systems
6. Project Manual-Division 26: Electrical

1.2. SUBMITTALS

A. Product Data: For each type or model include the following:

1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA certified chamber.
2. Sound performance data for both Supply Air and Exhaust Air, as tested in an AMCA certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Performance ratings for all chilled water or DX coils.
5. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
6. Estimated gross weight of each installed unit.
7. Installation, Operating and Maintenance manual (IOM) for each model.
8. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
9. Energy recovery performance data for both summer and winter operation.

1.3. QUALITY ASSURANCE

A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

C. Product Options: Drawings must indicate size, profiles and dimensional requirements of unit and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

D. End of line test with full report available upon request.

E. Certifications

1. Entire unit shall be ETL Certified per U.L. 1995 or U.L. 60335-2-40 and bear an ETL sticker.

2. Energy Recovery Device shall be AHRI Certified, per Standard 1060.
3. Coils shall be Recognized Components for ANSI/UL 1995, CAN / CSA C22.2 No 236.05.

1.4. COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.

B. Coordinate location of water system fittings to ensure correct positioning for connection to the water coil and condensate drain pipe.

C. Coordinate sequencing of construction of associated plumbing, HVAC, electrical supply, roofing contractor.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. Greenheck Fan Corporation
2. Approved Equivalent

2.2. MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake with 2" aluminum mesh filter assembly, exhaust air blower, evaporator coil, energy wheel, hot gas reheat coil, packaged DX system, phase and brownout protection, motorized dampers, motorized recirculating damper, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat and exhaust fan only power which have dual point power.

2.3. CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours. Uncoated galvanized steel exterior is not acceptable.
2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Rigid urethane injected foam. Foam board not acceptable.
   a. Thickness: 2 inch (50.8 mm)
   b. Thermal Resistance R13
   c. Thermally broken
   d. Meets UL94HF-1 flame requirements.
   e. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
2. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
   a. Thickness: 2 inch (50.8 mm)
   b. Thermal Resistance R8

c. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.

d. Location and application: Divider panels between outdoor air and return air/exhaust air streams.

C. Roof Insulation: 2 inch (50.8 mm) fiberglass located above the 1 inch (25.4 mm) foam panel.

D. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 22 gauge galvanized G90 steel or painted galvannealed steel.

E. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

F. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

G. Evaporator Coil: Evaporator coil shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

H. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.

I. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

J. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

K. Energy wheel: Bypass dampers are only acceptable during economizer operation – they cannot be used during normal operation. Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt or a link style belt with a five-year warranty. The wheel media shall be a polymer film matrix in a stainless-steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five-year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

L. Reheat coil with factory installed modulating hot gas reheat valve.

M. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Lead condenser fan shall have EC motor to maintain condenser pressure at part load conditions. Motors shall be UL Recognized and CSA Certified. The lead refrigerant compressor(s) shall be inverter hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Compressors shall be mounted within an insulated access compartment and on a raised cabinet shelf to

reduce sound and vibration. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

N. Condenser Fans: Fan blades must be constructed of aluminum or a composite material and have a geometry designed and documented to reduce sound and energy when compared to a traditional rectangular blade fan. Traditional rectangular blade fans are not allowed due to increased noise generated and increase power utilized. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan(s) will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point.] Motors shall be UL Recognized and CSA Certified. Single condenser fan running at max RPM and design static pressure shall not exceed an A-weighted sound power level of 75 db at free inlet/outlet test conditions.

O. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
   1. Global alarm condition (active when there is at least one alarm)
   2. Supply Air Proving alarm
   3. Dirty Filter Alarm
   4. Compressor Trip alarm
   5. Compressor Locked Out alarm
   6. Supply Air Temperature Low Limit alarm
      a. Sensor #1 Out of Range (outside air temperature)
      b. Sensor #2 Out of Range (supply air temperature)
      c. Sensor #3 Out of Range (cold coil leaving air temperature)

P. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

Q. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.

R. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in. Horizontal connections through unit only. Plenum curb for horizontal connections is not acceptable.

S. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the A / E. Service outlet requires a dedicated single phase electric circuit. Unit contains a 120 VAC transformer to provide power to service outlet.

2.4. BLOWER

A. Blower section construction, Supply Air: direct drive motors and blowers shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with aluminum wheel statically and dynamically balanced. Prop or belt-drive fan not acceptable due to low static capabilities.

D. Blades: Welded aluminum blades only.

E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5. MOTORS

A. General: Blower motors greater than 1/2 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

B. Motors shall be 60 cycle, 3 phase 208 volts.

2.6. UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for damper tracking.

E. Outside Air / Return Air damper control shall be field adjustable two-position.

F. Economizer control shall be temperature / enthalpy.

G. Dirty filter sensor shall be factory installed.

H. Operating protocol: The DDC shall be factory-programmed for BACNetMSTP.

I. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.7. FILTERS

A. Unit shall have permanent 2 inch (50.8 mm) aluminum filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 13 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

2.8 UNIT ACOUSTICS

A. All units shall be tested per AMCA 320-07 in an AMCA accredited sound chamber. Units shall be tested as a whole with all blowers and compressors running at full speed. Sound test data shall be provided from these tests and reported in five (5) planes of reference (unit left, right, front, back and top).

B. All measurements shall be taken at no more than 1ft from the unit and be reported in Lw/Lw(A).

C. Individual component acoustical tests with calculated unit acoustics will not be accepted.

D. All acoustical data must be guaranteed by the unit manufacturer. Any data labeled as informational only will not be acceptable.

E. **Any units that are not tested as per the above will require the following acoustical treatments**.

1. Acoustical roof curb that includes top spring vibration isolation rail and integral sound attenuating panels for the curb sides and bottom. All acoustical panels must be minimum

4” thick double wall and be provided with acoustical testing data from an accredited laboratory (NVLAP, ASTM-E477-20). This curb is to be provided in lieu of the curb specified in section 2.3.R.

2. Duct mounted elbow silencers for both supply and return ducts. Silencers must have a minimum average dynamic insertion loss of 17dB. Silencers must be provided with acoustical testing data from an accredited laboratory (NVLAP, ASTM-E477-20).
3. Silencer pressure drops shall be added to the scheduled external static pressures for supply and exhaust blowers.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3. CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

B. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.

C. Duct installation and connection requirements are specified in Division 23 of this document.

D. Electrical installation requirements are specified in Division 26 of this document.

3.4. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5. START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6. DEMONSTRATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

DIVISION 23-MECHANICAL

237433- INDOOR PACKAGED MAKE-UP AIR UNIT WITH HEATING

GENERAL

1.1. SUMMARY

A. This section includes Units with integral Heating. Integral heating source shall be Hot Water heating. Airflow arrangement shall be Outdoor Air only. Each unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in Section 2 of this specification.

B. Related sections include the following:

1. Project Manual Division 1 through 23: Scope of Work
2. Project Manual Division 1 through 23: General Provisions
3. Project Manual Division 23: Insulation
4. Project Manual Division 22: Plumbing
5. Project Manual Division 23: Automatic Temperature Control Systems
6. Project Manual Division 26: Electrical

1.2. SUBMITTALS

A. Product Data: For each type or model, include the following:

1. Complete fan performance curves for Supply Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
2. Sound performance data for Supply Air, as tested in an AMCA Certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
5. Estimated gross weight of each installed unit.
6. Installation, Operating and Maintenance manual (IOM) for each model.

1.3. QUALITY ASSURANCE

A. Source Limitations: Obtain Packaged Make-Up Air Unit with Integral Heating with all appurtenant components or accessories from a single manufacturer.

B. Product Options: Drawings must indicate size, profiles and dimensional requirements of Make-Up Air Units and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

C. Certifications:

1. Entire unit shall be ETL Certified per UL 60335-2-40 and bear an ETL mark
2. Coils shall be Recognized Components per UL 1995, CAN/CSA C22.2 No. 236.05. Coil performance shall be calculated in accordance with AHRI 410.

1.4. COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each Make-Up Air Unit and associated ducting, plumbing and electrical systems.

B. Coordinate sequencing of construction of associated plumbing, HVAC, and electrical supply.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. Greenheck Fan Corporation
2. Approved Equivalent

2.2. MANUFACTURED UNITS

A. Unit with Integral Heating shall be fully assembled at the the factory and consist of an insulated metal cabinet, hot water coil, sensors, freeze protection, motorized intake damper, supply air blower assembly, electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

2.3. CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation.

1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvanized steel. Base rail is 12 gauge, galvazined (G90) steel.
2. Internal assemblies: 24 guage, galvanized (G90) steel except for motor supports which shall be a minimum 14 guage galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
   a. Thickness: 1 inch (25 mm)
   b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
   c. Location and application: Floor of each unit shall be insulated with fiberglass insulation. Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified.

C. Access panels: Unit shall be equipped with insulated hinged access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel.

D. Supply Air blower assembly options: Direct-drive fan(s): Blower assembly shall consist of an electric motor as specified by A/E. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on minimum 1.125 inch thick neoprene vibration isolators. Blower motor(s) shall be capable of continuous speed modulation and controlled by a factory supplied VFD.

E. Control center / connections:

1. Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

F. Hot Water Coil: A water coil for heating shall be factory-installed in the unit for connection to a building steam source. Coil shall be Recognized Components per UL 1995, CAN/CSA C22.2 No. 236.05. Coil performance shall be calculated in accordance with AHRI 410. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame.

G. Motorized Inlet Air Damper: to be of low leakage type and shall be factory installed.

H. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.

I. Frost Control for optional water coil.

2.4. BLOWER-DD

A. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower and must have neoprene vibration isolation devices, minimum of 1-1/8 inches thick.

B. Fan: Airfoil plenum fan statically and dynamically balanced, AMCA certified for air and sound performance.

C. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

D. Proceed with installation only after all unsatisfactory conditions have been corrected.

2.5. MOTORS

A. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.

B. Motors shall be 60 cycle, 3 phase, 208 volt.

2.6. UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating system controlled by factory-supplied remote panel, thermostats and sensors or it can be operated as a heating system controlled by a Building Management System (BMS).

B. Variable Frequency Drive (VFD): Unit shall have factory installed variable frequency drive for modulation of the supply air blower assembly. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

C. Sensors to be provided with the unit:

1. Heating Inlet Air Sensor
2. Dirty Filter Sensor

2.7. FILTERS

A. Unit shall have 2" thick MERV 8 disposable pleated filters following the outdoor air intake in a V-bank arrangement and shall be accessible from the exterior of the unit.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3. CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

1. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
2. Duct installation and connection requirements are specified in Division 23 of this document.
3. Electrical installation requirements are specified in Division 26 of this document.

3.4. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5. START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6. DEMONSTRATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire Make-Up Air unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

DIVISION 23-MECHANICAL
237488- DEDICATED OUTDOOR AIR SYSTEMS WITH ENERGY RECOVERY WHEEL/HEATING/COOLING

PART 1 - GENERAL

1.1. SUMMARY

A. This section includes units with integral cooling for outdoor installation. Integral Energy Recovery device shall be a rotary air-to-air total enthalpy wheel. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air only. Each unit shall incorporate additional product requirements as listed in Section 2 of this specification.

B. Related Sections include the following:

1. Project Manual Division 1 through 23: Scope of Work
2. Project Manual Division 1 through 23: General Provisions
3. Project Manual Division 23: Insulation
4. Project Manual Division 22: Plumbing
5. Project Manual Division 23: Automatic Temperature Control Systems
6. Project Manual Division 26: Electrical

1.2. SUBMITTALS

A. Product Data: For each type or model include the following:

1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA certified chamber.
2. Sound performance data for both Supply Air and Exhaust Air, as tested in an AMCA certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Performance ratings for all chilled water or DX coils.
5. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
6. Estimated gross weight of each installed unit.
7. Installation, Operating and Maintenance manual (IOM) for each model.
8. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
9. Energy recovery performance data for both summer and winter operation.

1.3. QUALITY ASSURANCE

A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

C. Product Options: Drawings must indicate size, profiles and dimensional requirements of unit and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

D. End of line test with full report available upon request.

E. Certifications

1. Entire unit shall be ETL Certified per U.L. 1995 or U.L. 60335-2-40 and bear an ETL sticker.

2. Energy Recovery Device shall be AHRI Certified, per Standard 1060.
3. Coils shall be Recognized Components for ANSI/UL 1995, CAN / CSA C22.2 No 236.05.

1.4. COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.

B. Coordinate location of water system fittings to ensure correct positioning for connection to the water coil and condensate drain pipe.

C. Coordinate sequencing of construction of associated plumbing, HVAC, electrical supply, roofing contractor.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. Greenheck Fan Corporation
2. Approved Equivalent

2.2. MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake with 2" aluminum mesh filter assembly, exhaust air blower, evaporator coil, energy wheel, hot gas reheat coil, packaged DX system, phase and brownout protection, motorized dampers, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat and exhaust fan only power which have dual point power.

2.3. CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours. Uncoated galvanized steel exterior is not acceptable.
2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Rigid urethane injected foam. Foam board not acceptable.
   a. Thickness: 2 inch (50.8 mm)
   b. Thermal Resistance R13
   c. Thermally broken
   d. Meets UL94HF-1 flame requirements.
   e. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
2. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
   a. Thickness: 2 inch (50.8 mm)
   b. Thermal Resistance R8

c. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.

d. Location and application: Divider panels between outdoor air and return air/exhaust air streams.

C. Roof Insulation: 2 inch (50.8 mm) fiberglass located above the 1 inch (25.4 mm) foam panel.

D. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvannealed steel.

E. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

F. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

G. Evaporator Coil: Evaporator coil shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

H. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.

I. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

J. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

K. Energy wheel: Unit energy wheel shall be sized for the full volume of outdoor and exhaust air without an energy wheel bypass damper(s). Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt or a link style belt with a five-year warranty. The wheel media shall be a polymer film matrix in a stainless-steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five-year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

L. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.

M. Reheat coil with factory installed modulating hot gas reheat valve.

N. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Lead condenser fan shall have EC motor to maintain condenser pressure at part load conditions. Motors shall be UL Recognized and CSA Certified. The lead refrigerant compressor(s) shall be inverter hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices.

Compressed refrigerant system shall be fully charged with R-410A refrigerant. Compressors shall be mounted within an insulated access compartment and on a raised cabinet shelf to reduce sound and vibration. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

O. Condenser Fans: Fan blades must be constructed of aluminum or a composite material and have a geometry designed and documented to reduce sound and energy when compared to a traditional rectangular blade fan. Traditional rectangular blade fans are not allowed due to increased noise generated and increase power utilized. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan(s) will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point.] Motors shall be UL Recognized and CSA Certified. Single condenser fan running at max RPM and design static pressure shall not exceed an A-weighted sound power level of 75 db at free inlet/outlet test conditions.

P. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
   1. Global alarm condition (active when there is at least one alarm)
   2. Supply Air Proving alarm
   3. Dirty Filter Alarm
   4. Compressor Trip alarm
   5. Compressor Locked Out alarm
   6. Supply Air Temperature Low Limit alarm
      a. Sensor #1 Out of Range (outside air temperature)
      b. Sensor #2 Out of Range (supply air temperature)
      c. Sensor #3 Out of Range (cold coil leaving air temperature)

Q. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

R. Motorized dampers / Intake Air, Exhaust Air, Motorized dampers of low leakage type shall be factory installed.

S. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 24 in.

T. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the A / E. Service outlet requires a dedicated single phase electric circuit. Unit contains a 120 VAC transformer to provide power to service outlet.

2.4. BLOWER

A. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with aluminum wheel statically and dynamically balanced. Prop or belt-drive fan not acceptable due to low static capabilities.

D. Blades: Welded aluminum blades only.

E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5. MOTORS

A. General: Blower motors greater than 1/2 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

B. Motors shall be 60 cycle, 3 phase 208 volts.

2.6. UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be

F. Economizer control shall be temperature / enthalpy.

G. Dirty filter sensor shall be factory installed.

H. Operating protocol: The DDC shall be factory-programmed for BACNetMSTP.

I. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.7. FILTERS

A. Unit shall have permanent 2 inch (50.8 mm) aluminum filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

2.8 UNIT ACOUSTICS

A. All units shall be tested per AMCA 320-07 in an AMCA accredited sound chamber. Units shall be tested as a whole with all blowers and compressors running at full speed. Sound test data shall be provided from these tests and reported in five (5) planes of reference (unit left, right, front, back and top).

B. All measurements shall be taken at no more than 1ft from the unit and be reported in Lw/Lw(A).

C. Individual component acoustical tests with calculated unit acoustics will not be accepted.

D. All acoustical data must be guaranteed by the unit manufacturer. Any data labeled as informational only will not be acceptable.

E. **Any units that are not tested as per the above will require the following acoustical treatments**.

1. Acoustical roof curb that includes top spring vibration isolation rail and integral sound attenuating panels for the curb sides and bottom. All acoustical panels must be minimum

4” thick double wall and be provided with acoustical testing data from an accredited laboratory (NVLAP, ASTM-E477-20). This curb is to be provided in lieu of the curb specified in section 2.3.R.

2. Duct mounted elbow silencers for both supply and return ducts. Silencers must have a minimum average dynamic insertion loss of 17dB. Silencers must be provided with acoustical testing data from an accredited laboratory (NVLAP, ASTM-E477-20).
3. Silencer pressure drops shall be added to the scheduled external static pressures for supply and exhaust blowers.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3. CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

B. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.

C. Duct installation and connection requirements are specified in Division 23 of this document.

D. Electrical installation requirements are specified in Division 26 of this document.

3.4. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5. START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6. DEMONSTRATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 238223 – UNIT VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division 01 Specification sections, apply to work of this section.

1.02 SUMMARY

A. Extent of unit ventilator work indicated on drawings and schedule by requirements of this section.

B. Unit ventilators specified in this section include the following:

1. Hot water-heating coil.
2. Steam Heating Coil
3. Chilled water-cooling coil (where applicable).
4. DX Cooling Coil (where applicable).

C. Related Sections: Refer to other Div. 23 sections for the following:

1. Hot/Chilled water piping
2. Refrigerant Piping
3. Steam Piping

D. Other divisions: Refer to Div. 26 sections for the following:

1. Power wiring

1.03 SUBMITTALS

A. Product data - submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialities and accessories, and installation and start-up instructions.

B. Shop drawings - submit manufacturer's assembly type shop drawings indicating dimensions, weight loadings, required clearances and methods of assembly of components. Wiring diagrams - submit manufacturer's electrical requirements for power supply wiring for packaged heating and cooling units. Submit manufacturer's ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

C. Maintenance data - submit maintenance data and parts list for each unit ventilator, control, and accessory, including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ARI 440 for testing and rating units.

C. Comply with ASHRAE 33 for testing hydronic coils.

D. Comply with NFPA 70 for components and installation.

E. UL Compliance - provide unit ventilators which are listed by UL and have UL label affixed.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace unit ventilators that fail in materials and workmanship within 2 years from date of substantial completion.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match product installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Unit Ventilator Filters: Furnish 2 spare filters for each filter installed.
2. Motors: Furnish (2) spare motors for each size unit ventilator motor size used on the project.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle unit ventilators and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged packaged heating and cooling units or components, replacewith new.

B. Store unit ventilators and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Magic Aire / Carrier
2. Modine Corporation
3. Carrier Corp.

2.02 UNIT VENTILATORS

A. Description: A vertical, floor-mounting assembly including cabinet, filter, coil, fan and motor in draw-through configuration with the following:

1. Cooling coil
2. Heating Coil, reheat position.
3. Temperature controls (field installed)

2.03 MATERIALS

A. Unit Frame: Welded, galvanized heavy gage steel.

B. Insulation: 1-inch (25mm) duct liner complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

1. Fire-Hazard Classification: Duct liner and adhesive shall have a maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

C. Drain Pans: Galvanized steel, with connection for drain. Drain pan shall be insulated with polystyrene or polyurethane insulation.

D. Cabinet: Galvanized steel, with removable panels fastened with tamperproof fasteners and key-operated access door.

E. Cabinet Finish: Phosphatize coat with baked-on primer and manufacturer's standard paint, in color selected by Architect.

F. Cabinet Top: Galvanized steel, with baked enamel finish.

G. Discharge Air: Welded steel linear bar grille.

1. Air-Outlet Location: Top

H. Outdoor Louver: Types and sizes as scheduled with the following features and provisions:

1. Horizontal wall intake louver.
2. Construction: Aluminum.
3. 1/2-inch (13 mm) mesh screen on interior side of intake.
4. Finish: Clear anodized to match existing.
5. Protective grille for louver – clear anodized to match existing conditions.

I. Mixing Dampers: Steel damper blades with edge and side seals and nylon bearings, operated by factory-mounted operator to control outside-air/return air.

J. Face and Bypass Dampers (Where applicable): Steel damper bladed with edge and side seals and nylon bearings, operated by factory-mounted electric operator.

2.04 COILS

A. Hot Water / Steam Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 300 psig (2068 kPa) and a maximum entering water temperature of 275 deg. F (135 deg. C) with manual air vent and drain plug.

B. Chilled Water Coil: Copper tube, with mechanically bonded aluminum fans spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 200 psig (1378 kPa) with manual air vent and drain plug.

C. DX Coils for VRF: Provide cooling coils that are performance certified by the VRF manufacturer. Coils to be rated to 700 psi pressure certification. Electronic expansion valve kits to be supplied and certified by the VRF manufacturer.

2.05 FAN

A. Centrifugal, with forward-curved wheels and fan scrolls made of galvanized steel or thermoplastic material; directly connect to motor.

2.06 FAN MOTORS

A. Permanent split capacitor multispeed motor with integral thermal-overload protection and resilient mounts. Connect motor to chassis wiring with plug connection.

2.07 FILTERS

A. Filters: 1-inch (25-mm) thick, glass-fiber media.

2.08 ACCESSORIES

A. Storage Cabinets:

1. Material: Bottom, back and sides of cabinet to be 18-ga. Steel. Fully adjustable shelves to be 18-ga. Steel. Unit base to be 16-ga. Steel.

2. Cabinet to have open space with false back for piping and electrical circuits.

3. Finish: powder coat finish with color selected by architect.

4. Units to be provided with sizes and quantities shown on architectural drawings.

2.09 CONTROL SYSTEMS

A. Automatic Temperature Controls: Field installed controls to be furnished as described under section 230900 of this specification. In addition to section 230900, the following control items shall be included.

1. Provide occupant adjustment capability for the following:

a. Room temperature set point.
b. Minimum outside-air percentage.
c. Unoccupied room temperature set point.

2. Controls components shall include the following.

a. Thermistor mounted in unit return air with manual adjustable override.
b. Unit capillary manual reset freezestat, covering entire face of coil.
c. Ventilation lockout relay to close ventilation damper during occupied operation.
d. Exhaust fan interlock relay to open outside damper when exhaust fan is on or to open depressurization damper when outdoor air damper is open (dampers to operate in parallel).
e. Day-night control switch.
f. Day-night control relay for remote signal.

B. Safety Devices: Each unit shall have the following safety devices:

1. Manual disconnect switch.
2. Spring-loaded interlock de-energize control circuit, fan, and heating elements when front panel is removed.
3. Heat-dissipation switch keeps fans running when unit discharge temperature rises above 100 deg. F (38 deg. C).

4. Overcurrent protective fuses.
5. Branch-circuit fusing to protect heating-element subdivision circuits (maximum 48 A).
6. Motor and control circuit fuses.
7. Low-temperature, cutout thermostat strapped to air coil prevents coil from freezing and liquid from slugging.

C. Control Devices: Field mount the following devices:

1. Outside-air damper actuator.
2. Discharge air thermostat.
3. Heating-coil valve.
4. Cooling-coil valve (where applicable).
5. Face and bypass damper actuator (where applicable).
6. Room thermostat.
7. Freeze protection thermostat.
8. Cooling lockout thermostat.

2.10 SOURCE QUALITY CONTROL

A. Verification of Performance: Test and rate condensing units according to ARI 210/240.

B. Test unit ventilator coils according to ASHRAE 33.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install unit ventilators to comply with NFPA 90A.

B. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.

C. Mechanical Contractor to install storage cabinets per architectural drawings/details unless otherwise indicated on the drawings.

3.02 CONNECTIONS

A. Unless otherwise indicated, install shutoff valve and union or flange at each connection.

B. Install piping adjacent to machine to allow service and maintenance.

3.03 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control testing and report results in writing:

1. After electrical circuitry has been energized, start units to conform proper motor rotation and unit operation.

2. Test and adjust controls and safeties.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

END OF SECTION

DIVISION 23 - MECHANICAL

SECTION 23 82 36 - HEATING AND COOLING TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY OF ITEMS INCLUDED

A. Extent of terminal unit work is indicated by drawings and schedules, and by work of this section.

B. Types of terminal units specified in this section include the following:

1. Hot water cabinet unit heaters.
2. Finned-tube radiation.

C. Refer to Division 26 sections for wiring work, not work of this section.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, clearly indicating dimensions, weights (shipping and installed), furnished accessories, installation and start-up instructions. Provide units of same manufacturer if various types used on same projects, wherever possible.

B. Shop Drawings: Submit shop drawings showing unit dimensions, details, method of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply and control wiring to equipment. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

D. Maintenance Data: Submit maintenance data and parts list for each type of equipment, accessory and control. Include this data and product data in maintenance manual, in accordance with Division 01 requirements.

1.3 QUALITY ASSURANCE

A. Provide units which have been tested and rated in accordance with AMCA Standards and bear AMCA Certified Rating Seal.

B. Provide coil units which have been tested and rated in accordance with ARI and ASHRAE Standards and bear ARI Certified Rating Seal.

C. Provide units which have been listed and labeled by UL.

D. Provide motors and electrical accessories complying with NEMA standards, and complying with NEC code for workmanship installation requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver units with factory installed shipping skids and lifting lugs, pack components in factory fabricated protective containers.

B. Handle units carefully to prevent damage to components and finish. Do not install damaged components.

C. Protect units from weather, dirt, construction traffic and debris, etc.

PART 2 - PRODUCTS

2.1 HOT WATER CABINET UNIT HEATERS

A. General: Provide cabinet unit heaters of capacities as shown on schedules. Each cabinet heater shall be factory assembled unit consisting of a filter, heating coil, fan with motor and casing with inlet and outlet grilles.

B. Cabinets: Provide steel cabinet for floor, wall, or ceiling mounting as indicated on the drawings and with approved steel bases or supports.

1. Front of cabinet shall be removable and shall be not less than 16 gauge steel.
2. The back shall be not less than No. 20 gauge steel.
3. Cabinet shall be provided with steel supports for fan, heating coil and filter, and steel reinforcing members to provide a rigid exposed casing and a rigid silent operating unit.
4. Provide enclosures suitable for the spaces available, complete with inlet and aluminum or steel outlet grilles, doors for access to valves and traps.
5. Cabinets shall be galvanized or bonderized, and finished with rust inhibiting paint at the factory.
6. Backs of recessed enclosures shall be insulated with not less than 1/2 inch rigid fireproof insulation.

C. Water Coils: Construct in accordance with ARI 410. Provide copper tubing, expanded into aluminum or copper fins.

D. Fans: Provide fans of centrifugal type with one or more wheels mounted on a single shaft.

1. Fan wheels, shaft, bearings and fan housing shall be mounted as an integral assembly on a steel mounting plate and securely fastened to the enclosures.
2. Bearings of fan and motor shall be self-aligning permanently lubricated ball bearing type.

E. Fan Motors: Provide permanent split capacitor fan motors with integral thermal over-load protection, in accordance with NEMA MG 1. Wiring in accordance with NEC code.

F. Filters: Provide 1-inch thick filters of the throwaway type, unless otherwise noted, mounted in tight fitting slide-out frames arranged to prevent passage of unfiltered air.

G. Ratings: Provide cabinet unit heaters tested and rated in accordance with AMCA 210.

H. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:

1. Sterling
2. Dunham-Bush, Inc.
3. Trane Co.

2.2 FINNED TUBE RADIATION

A. General: Provide finned tube radiation of lengths and in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Enclosures: Minimum 18 gauge cold-rolled steel full backplate, minimum 16 gauge front. Brace and reinforce front minimum of 4 feet on center without visible fasteners.

C. Elements: Copper tube and aluminum fins, with tube mechanically expanded into fin collars to eliminate noise and insure durability and performance at scheduled ratings. Alternatively, provide steel plate elements.

D. Finish: Flat black heat resisting paint for backplate; factory finished baked enamel, standard colors, on fronts and accessories.

E. Accessories: Provide accessories as follows:

1. End panels, inside and outside corners, and enclosure extensions.
2. Access panels in front of valves, balancing cocks, and traps.
3. Factory-mounted dampers, with allen wrench operator.
4. Column enclosures.

F. Manufacturer: Subject to compliance with requirements, provide finned-tube radiation of one of the following:

1. Zehnder-Rittling
2. Sterling Radiator
3. Trane Co.
4. Vulcan

PART 3 - EXECUTION

3.1 INSTALLATION OF HOT WATER CABINET UNIT HEATER

A. General: Install hot water and steam cabinet unit heaters as indicated on the drawings and in accordance with manufacturer's installation instructions.

B. Piping: Provide connections to unit heaters as shown on the drawings.

3.2 INSTALLATION OF FINNED TUBE RADIATION AND RADIANT HEATERS

A. General: Install radiation as indicated, and in accordance with manufacturer's installation instructions. Include expansion compensation, anchors and guides on piping.

B. Locate radiation on outside walls as indicated, run cover wall-to-wall unless otherwise indicated.

C. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.

D. Install end caps where units butt against walls. Install access panels centered in front of each shutoff valve, balancing cock, steam trap, or temperature control valve,

3.3 ELECTRICAL WIRING

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to the electrical subcontractor.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment subcontractor.

3.4 ADJUSTING AND CLEANING

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum terminal coils and inside of cabinets.

B. Finish: Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Filters: Install new filter units for terminals prior to final acceptance.

END OF SECTION

DIVISION 23-MECHANICAL

238239 – HYDRONIC CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cabinet unit heaters with centrifugal fans and hot-water coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. LEED Submittal:

1. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment complies.
2. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Details of anchorages and attachments to structure and to supported equipment.
4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
5. Location and arrangement of piping valves and specialties.

6. Location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling Security Cameras

6. Perimeter moldings for exposed or partially exposed cabinets.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For unit heaters to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters (where applicable).

G. Warranty: 2 Year manufacturer's standard warranty from date of shipment.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. Equipment manufacturer shall be ISO 9001:2008 certified.

1.6 COORDINATION

A. Coordinate layout and installation of fan-coil units and mounting system components with other construction that penetrates or is supported by walls and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Motor failure.
b. Coil leak.

2. Warranty Period: Two years from date of Shipment.
3. Warranty Period (Motor Only): Two years from date of Shipment.
4. Warranty Period (Coil Only): Two years from date of Shipment.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In the Cabinet Unit Heater Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
3. Basis-of-Design Product: The design for each cabinet unit heater is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 CABINET UNIT HEATERS

A. Basis-of-Design Product: Zehnder Rittling or a comparable product by one of the following:

B. Manufacturers:
1. Zehnder Rittling

C. Description: Factory-packaged and -tested units rated according to ASHRAE 33 and UL 1995.

D. Insulation: ½" thick elastomeric closed cell foam insulation complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84 and UL 723.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21 and ASTM G-22.

E. Chassis: 20 gauge galvannealed steel where exposed to moisture.

F. Cabinet: 16 gauge steel baked epoxy powder coating in manufacturer's standard paint color as selected by Architect.
1. Horizontal Units:
   a. The front panel shall be hinged, 16 gauge steel providing full swing through 90° including removable safety chain(s) to prevent the panel from swinging fully open accidentally. Includes channel-formed edges and ¼-turn allen-head cam fasteners.
2. End pockets shall be no less than 8” in width, located on both sides of the unit.
3. Steel recessing flanges for recessing fan-coil units into wall or ceiling.
4. All concealed units shall have a minimum 1" duct collar on the discharge.

G. Filters: Minimum arresta nce according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. 1” Reinforced Non-woven Media Throwaway: 95 percent arrestance and 13 MERV.

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.083 inch (2.1 mm), rated for a minimum working pressure of 300 psig (2067 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Minimum copper tube thickness shall be 0.016”. Minimum fin thickness shall be 0.0045”. Lanced fins shall not be acceptable. Coils shall be circuited for counter flow to maximize unit efficiency. Coil casing shall be fabricated from galvanized steel. Include manual air vent and drain valve.

I. Fan and Motor Board: Constructed from 18 gauge galvannealed steel.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. galvanized-steel wheels and fan scrolls.
2. Motor: Electronically commutated high-efficiency, programmable brushless DC motor; resiliently mounted on motor board. Shaded pole motors are not acceptable. Single speed motors are not acceptable. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

J. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

K. Basic Unit Controls:
1. Control voltage transformer.
2. 24V Relay

L. Electrical Connection: Factory wire motors and controls for a single electrical connection.

1. Provide a service disconnect switch to isolate power from the unit during maintenance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for [piping and] electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Install cabinet unit heaters and propeller unit heaters level and plumb.

D. Suspend cabinet unit heaters from structure with elastomeric hangers Vibration isolatorsare specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Suspend propeller unit heaters from structure with all-thread hanger rods. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

G. Install new filters in each cabinet unit heater within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

E. Comply with safety requirements in UL 1995.

F. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of unit heater. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."

G. Unless otherwise indicated, install union and gate or ball valve on steam-supply connection and union, strainer, steam trap, and gate or ball valve on condensate-return connection of unit heater. Steam specialties are specified in Division 23 Section "Steam and Condensate Heating Piping."

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters or propeller unit heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238239

Part 1 General

1.1 SECTION INCLUDES

A. Electric cabinet unit heaters.

1.2 RELATED SECTIONS

A. Division 23 Specifications - Motors.

B. Division 23 Specifications – Automatic Temperature Control Systems.

C. Division 26 Specifications - Electrical

1.3 REFERENCES

A. CSA-US.

B. UL (Underwriters Laboratories Inc.).

1.4 SUBMITTALS FOR REVIEW

A. Division 1 and 23 Specifications: Submission procedures.

B. Product Data: Provide typical catalogue of information including arrangements.

C. Shop Drawings:

1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
3. Indicate mechanical and electrical service locations and requirements.

1.5 CLOSEOUT SUBMITTALS

A. Division 1 and 23 Specifications: Submission procedures.

B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

C. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

D. Record Documentation: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum thirty (30) years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL.

1.8 WARRANTY

A. Division 1 Specifications: Warranties.

B. Provide three (3) year manufacturer's warranty.

Part 2 Products

2.1 CABINET HEATERS

A. Manufacturers:

1. Stelpro
2. Approved Equivalent

B. Assembly: listed and labelled assembly with terminal box and cover, and controls.

C. Heating Elements: Instant-heating, nichrome, open type.

D. Cabinet: Epoxy polyester powder coat finish, [color by architect] with fixed louvres. Field-adaptable airflow configurations.

1. Material: 18 gauge satin coat steel, 16 gauge front panel.
2. Width: 24 inch. Or 36 inch.
3. Back panel: Factory finished, with knockouts.

E. Mounting: Recesssed wall or recessed ceiling (as scheduled).

F. Element Hangers: Steel, porcelain enamelled.

G. Fan: Direct drive centrifugal type, statically and dynamically balanced.

H. Motor: 50 W, 1/15 hp size, permanently lubricated, totally enclosed sleeve bearing type.

I. Control: Factory wired switches installed behind cover. Provide easy access junction box.

1. Thermostat: Built-in (or by others, as scheduled)
    a. Built-in thermostats shall be factory mounted and wired.
2. Optional Disconnect Switch: Factory mounted.
3. Thermal overload protection, automatic reset.

J. Electrical Characteristics:

1. Capacity: As per schedule
2. Control circuit: 24 VAC for stats by others and line-voltage for built-in.
3. Power: 208 volts, three-phase, 60 Hz.
4. Refer to Division 23 Electrical Specifications.

2.2 ACCESSORIES

A. Recess trim kit, where required

Part 3 Execution

3.1 INSTALLATION

A. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

B. Protection: Provide finished cabinet units with protective covers during balance of construction.

C. Install electric heating equipment including devices provided by manufacturer but not factory-mounted. Provide copy of manufacturer's wiring diagram submittal. Install electrical wiring to manufacturer's submittals and Section 26 05 80.

3.2 CLEANING

A. Division 1 Specifications: Cleaning installed work.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes general, procedural, and administrative requirements, for electrical products, equipment, and installation practices applicable to this Division.

1.02 RELATED DOCUMENTS

A. All Contract drawings, Contract General and Supplementary Conditions, Division 01 Specification Sections, and Bidding Requirements apply to this section.

B. The requirements of this section shall apply to all other sections of Division 26.

C. The general electrical requirements of this division shall also apply to:

1. Division 23 – Heating, Ventilating and Air Conditioning
2. Division 27 – Communications
3. Division 28 – Electronic Safety and Security

1.03 SCOPE OF WORK

A. It is the declared intent of the project drawings and these specifications that the contractor shall provide for the complete installation of operational electrical circuits and systems as outlined in the project documents.

B. The Electrical Contractor shall provide all materials, equipment, labor, transportation, storage, etc., as necessary for, and incidental to, the completion of all electrical work as indicated on the Drawings and in these Specifications.

C. Included in the above is all related electrical demolition activities, temporary electrical facilities to support the work, final testing, adjusting training as applicable.

D. Before submitting his proposal, the Electrical Contractor shall be fully informed to the extent, character, and intent of the work to be done by him. No consideration will be granted for any misunderstanding of the material to be furnished or work to be performed.

1.04 USE AND INTERPRETATION OF DRAWINGS

A. The drawings are intended to be diagrammatic in nature and are for general electrical design and arrangement of circuits and components. Drawings do not detail every component of the electrical work, nor do they detail complete routing paths. Unless otherwise noted, the locations and elevations of electrical system components are approximate. Exact final locations are subject to the approval of the Owner's Representative. Additional minor adjustments may also be required to avoid conflicts with furniture or other obstructions or field condions. Similarly, the routing of services, feeders, branch circuits, system wiring, as indicated on the drawings, is not intended to be the exact routing. Verify routing with Owner’s Representative.

B. Unless specifically noted otherwise, branch circuit designations, i.e. “home run” designations, are for grouping purposes only to indicate the panelboard or interconnection box from which the branch circuit is served. Actual panel pole circuit numbers are to be determined in the field.

C. Drawings do not show all offsets, fittings, supports, pull or splice interferences, and elevation changes. Adjust installation of conduit, equipment location, etc. to accommodate work with the obstacles and interferences. Where a major and important rearrangement is necessary, report same to Architect for review. Obtain written approval for all major changes.

D. Cooperate with all other Contractors and Owners and determine the exact route of all raceways and location of all equipment the Drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions or details. Install work substantially as indicated. Exact equipment locations and raceway routing, etc. shall be governed by actual field conditions and/or instructions of the Engineer and/or Owner's Representative.

E. During the course of the work, should any ambiguities or discrepancies be found on the drawings or in the specifications, to which the Contractor has failed call attention before submission of his bid, then the Engineer shall interpret the intent of the drawings and specifications, and the Contractor hereby agrees to abide by the Engineer's interpretation and agrees to carry out the work in accordance with the decision of the Engineer. It is expressly stipulated that neither the drawings nor the specifications shall take precedence, one over the other, with the exception the more stringent requirement shall prevail, and it is further stipulated that the Engineer may interpret or construe the drawings and specifications of the work, and of that question, the Engineer shall be the sole judge.

1.05 COMPLETE SYSTEMS

A. The drawings and specifications are intended to provide for a complete, operational electrical installation. However, both the drawings and specifications are for the Electrical Contractor's guidance and are in no way intended to give every detail of the existing conditions or new installations, nor do they describe every fitting required for the installation of the work. The Electrical Contractor shall furnish, install, and place in workmanlike manner all equipment, accessories, supports, fittings, backboxes and all other material needed for a complete electrical and operational installation. The Electrical Contractor shall make all final connections to equipment. The Electrical Contractor shall prepare such additional drawings as necessary or required for any purpose and shall submit them for the approval of the Engineer.

1.06 APPLICABLE CODES, STANDARDS AND REGULATIONS

A. Comply with NFPA 70 (National Electrical Code (NEC)), version currently adopted by the Authority Having Jurisdiction (AHJ). Comply with NECA (National Electrical Contractor's Association) Standards for minimum professional installation methods and practices. Comply with all applicable federal, state and local laws, ordinances, codes, rules and regulations. Where the Contract Documents exceed these requirements, the Contract Documents shall govern. In no case shall work be installed contrary to or below minimum legal standards. Comply with local authorities having jurisdiction (AHJ) and resolve any conflicts. Where conflicts between codes and standards arise, the more stringent requirements shall be adhered to.

B. The current applicable rules, restrictions and requirements of the utility companies providing service to the project site/facilities shall be adhered to. Provide all required coordination.

C. Should any materials installed, or work performed, be found to be not in compliance with any of the listed codes and regulations, provide all materials, labor, and pay all costs necessary to correct the deficiencies at no additional cost.

1.07 REFERENCE CODES & STANDARDS

A. All work shall be in accordance with:

1. New York State Uniform Fire and Prevention Codes and Supplements (latest editions in effect at time of bid):

   a. New York State Building Code
   b. New York State Existing Building Code
   c. New York State Energy Conservation Code
   d. New York State Fire Code

2. The latest editions at time of bid (unless otherwise noted) of the below standards of the following:

a.	ADA	Americans with Disabilities Act
b.	ASA	American Standards Association
c.	ASTM	American Society for Testing Materials
d.	ETL	Electrical Testing Laboratories, Inc
e.	IES	Illuminating Engineering Society of North America.
f.	IEEE	Institute of Electrical and Electronic Engineers
g.	IPCEA	Insulated Power Cable for Engineers Association
h.	OSHA	Occupational Safety and Health Act
i.	NEC	National Electric Code (2017)
j.	NECA	National Electrical Contractor's Association
k.	NEMA	National Electrical Manufacturers Association
l.	NESC	National Electrical Safety Code
m.	NFPA	National Fire Protection Association
n.	UL	Underwiter's Laboratories

3. Listings: All equipment, materials and devices shall be listed and labelled by a Nationally recognized Testing Laboratory (NRTL), such as Underwriters Laboratories, Inc (UL) for the intended use and shall bear its label.

4. The Rules and Regulations of the local utilities providing service to the project location.

5. The Rules and Regulations of the local Authority Having Jurisdiction (AHJ).

6. The Directives of the Owner of the Facility where the work is being performed.

B. Before submitting his bid, the Electrical Contractor shall be familiar with the rules of the aforementioned Boards, Departments, Agencies, etc. having jurisdiction, applicable Codes. and shall notify the Engineer with his bid, if in his opinion any work or materials specified is contrary to any such rules. Otherwise, the Electrical Contractor shall be responsible for the approval of all work or materials and in case the use of any material specified is not permitted, a substitute approved by the authorities and by the Engineer shall be furnished and installed without additional cost to the Owner.

1.08 DEFINITIONS

As Specified	All materials, equipment including the execution thereof as called for/shown in the Contract Documents.
Code Requirements	Minimum requirements necessary for compliance with applicable codes.
Concealed	Work not readily visible, including, but not limited to that which is inside walls, above ceilings, below or within slabs, below grade, within pipe and duct shafts chases or recesses.
Exposed	Work readily visible, including, but not limited to, that which is installed on wall/ceiling surfaces, below ceilings, etc. or otherwise not concealed.

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
Furnished by Others	Materials, equipment provided by others received and/or installed by the Electrical Contractor. It includes receiving delivery at job site.
Inspection	Visual observations by Owner, his Site Representative, Architect/Engineer, or another Agency.
Install	All labor and materials necessary, and incidental to, the mount or place equipment, etc., completely connect and make operational.
Labeled	Classification by a standards agency.
Provide	Furnish and install complete and operational.
Relocate	Disconnect, disassemble, and transport equipment to new locations, then clean, install and test and make ready for use. All necessary wiring and raceway extensions shall be considered incidental to the relocation process.
Remove	Disconnect, disassemble, dismount and dispose of off-site, including all associated appurtenances, wiring and raceway rendered unnecessary by the removal.
Reinstall	All labor and materials necessary, and incidental to, mount or place previously removed equipment at or near its pre-existing location. Clean completely connect and make operational. Includes minor wiring rework necessary.
Remove	Disconnect, disassemble and dispose. Includes demolition of associated wiring and conduit rendered unnecessary by removal of subject item.
Replace	Remove and provide new item.
Review	A general contractual conformance check of specified products.
Roughing	Conduit, backboxes etc. pursuant to equipment layout and installation.
Safe Off	De-energize, disconnect and make safe for removal or other work in the area by the Electrical Contractor or by Others.
Satisfactory	In conformance with and as specified in Contract Documents.
Site Representative	Owner’s designated Construction Manager or Inspector at the work site.

1.09 EXISTING CONDITIONS

A. The Electrical Contractor, before submitting his bid, shall examine the site to which this work is in any way dependent upon according to the intent of these specifications and accompanying drawings. He shall report to the Architect/Engineer, in writing, prior to bid, any conditions which prevent him from performing his work. No “Waiver of Responsibility” for inadequate, incomplete, or defective work will be considered by the Engineer unless written notice had been filed by the Electrical Contractor with his bid.

B. Where existing electrical systems of any voltage or purpose, or portions thereof, are to be re-used or modified, the Electrical Contractor shall test the affected portions for the purpose of identifying

pre-existing operational deficiencies. This shall include, but is not limited to, fire alarm, public address, security, CCTV, etc. Report any deficiencies, in writing, to the Owner or his designated representative. Deficiencies occurring after testing, not previously identified, shall be considered as a result of Contractor activities and shall be restored to working condition at no additional cost. If the Owner requests any of the pre-existing deficiencies be corrected by the Contractor, these shall be addressed at additional contract cost.

1.10 PERMITS, INSPECTIONS AND CERTIFICATES

A. The Electrical Contractor shall procure and pay for all necessary drawings, permits, inspections and certificates required by the various governing agencies, etc. having jurisdiction or utilities providing service as part of the bid and shall turn over to the Engineer all permits for construction before starting work and certificates of test, inspection, and approval before requesting payment.

B. Included in the above, the Electrical Contractor shall obtain a Certificate of Electrical Inspection for completed work from an approved third-party electrical inspection agency serving the project locale.

1.11 QUALITY ASSURANCE

A. The Electrical Contractor shall be regularly engaged in the production or installation of specified products, and systems for not less than three years.

B. All work under this Division shall be performed by a licensed electrician or done so under his direct supervision.

C. All painting, patching, concrete work, carpentry, welding, core drilling, etc. incidental to the completion of Division 26 work shall be performed by skilled tradespersons appropriate to the work.

1.12 SUBMITTALS

A. Within 30 days of the signing of the contract, prepare and submit for approval, per the procedures set forth in Division 01, all submittals required by Division 01, this Division and by all other Contract Documents.

B. Required submittals may include, but not be limited to: Schedule of Values; Subcontractor List(s); Product Data; Shop Drawings; Test Reports; Calculations, Photometric Analysis, Certifications; Warranties; Operation & Maintenance Manuals; Record Drawings and various administrative submittals. Provide samples or mock-ups upon request at no additional cost.

C. The number of copies submitted shall be as indicated in Division 01, or elsewhere in the Specifications or Contract Drawings. Electronic (.pdf or similar) may be submitted in lieu of hardcopies where permitted. Generally, all equipment and materials of the same classification, type or kind shall be submitted at one time.

D. For materials, devices, equipment, etc. to be installed, as required in subsequent individual Division 26 sections, submit product data consisting of manufacturer's standard catalog cuts, descriptive literature and/or diagrams, etc. Submittals shall be provided in sufficient detail so as to clearly indicate compliance with all specified requirements and standards. Documents shall be clearly marked to indicate proposed product, selected options, selected accessories, selected finishes, etc. Please clearly indicate any equipment tags for each item as indicated on Drawings for correlation.

E. For systems and equipment, as required in subsequent individual Divisions 26 sections provide project specific Shop Drawings which shall include all information listed in the Shop Drawings submittal requirements in the respective specification section. Include all pertinent information including, but not limited to, equipment/system identification, manufacturer/model, nameplate data,

dimensions, sizes, capacities, types, material, accessories and options, etc. Include any relevant performance data, system risers, wiring diagrams, etc. The documents provided shall be in sufficient detail so as to clearly indicate compliance with all project requirements and standards.

F. Any construction delays caused by failure to submit shop drawings on time or in the proper format shall be the responsibility of the Electrical Contractor.

G. Substitutions: Where products or materials are specified hereinafter by manufacturer's name and/or model number, they shall be considered as the standard and as most satisfactory for their purpose of use on the site or in the building. Another manufacturer's product other than those indicated may be submitted in lieu of the specified product with the understanding that the Engineer shall be the sole judge as to the equality to the specified item and acceptability of the submitted items. In addition, furnish to the Engineer or Owner upon request, and within 14 days of such a request, samples of any Base Bid and/or corresponding Alternate Bid item and/or intended substitute equipment, fixtures, etc. for their comparison and selection. Furnish any additional requested product information, calculations, etc. at no additional cost. Submission of substituted items is with the understanding that neither the Engineer nor the Owner is responsible for any delays or additional costs arising from review, acceptance, denial of said substituted item. Furthermore, any additional costs in material, labor, etc. or delays relating to the installation of substituted item shall be at no additional cost to the Engineer or Owner.

1.13 GUARANTEE

A. For guarantee requirements, refer to the applicable section of the Conditions of the Contract.

PART 2 – PRODUCTS

2.01 GENERAL

A. Except where existing materials and equipment are called for to be reused, all materials and equipment furnished and installed under Division 26 shall be new, of standard first grade quality, undamaged, defect-free, and correctly designed for their specific purpose. All new materials and equipment shall conform to the standards of and be listed/labeled by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL) and shall be approved for use by all local authorities having jurisdiction.

B. All equipment and material furnished shall be the manufacturer's standard item of production unless specifically specified or required to be modified to suit job conditions. Size, material; finish dimensions, and the capacities for the specified application shall be published in catalogs for national distribution by the manufacturer. Ratings and capacities shall be certified by a nationally recognized rating bureau.

C. Where specific devices, equipment, systems (or portions thereof) are indicated to be re-used, the Electrical Contractor, in the presence the Owner or his representative, shall verify proper operation of same prior to commencing work. Report any pre-existing defects or non-functioning items to the Engineer/Architect. The Electrical Contractor shall be held responsible for correcting and/or replacing any unreported items found to be defective up until Owner Acceptance at no additional cost.

D. Equipment and material fabricated specifically for use on this project shall be in strict accordance with the Drawings and Specifications and shall conform to the latest standards of the National Electric Manufacturer's Association.

E. All materials and equipment of one and the same kind, type, or classification and used for identical purpose shall be made by the same manufacturer.

2.02 NEW CIRCUIT BREAKERS INSTALLED IN EXISTING PANELBOARDS

A. New circuit breakers installed in existing panelboards shall be listed for use in the intended panelboard.

B. The new circuit breaker's interrupting rating shall meet or exceed the interrupting rating of the intended panelboard.

PART 3 – EXECUTION

3.01 GENERAL

A. The electrical installation work shall be in accordance with the intent of the Contract Documents, and applicable Codes and Standards, and manufacturer' as determined by the Engineer.

B. All materials and equipment shall be installed as in accordance with manufacturer's instructions, by mechanics experienced and skilled in their trade, in a neat and professional manner, in accordance with trade standards, and so as not to void any warranty or UL listing.

C. Any workmanship considered by the Architect/Engineer as being faulty or substandard shall be removed and replaced by the Contractor to the satisfaction of the Architect/Engineer at no additional cost to the Owner.

D. All work under the electrical contract shall be performed under the Contractor's direct supervision. Provide sufficient and qualified personnel necessary to complete the work in accordance with the Contract Documents and in accordance with the project schedule.

E. Prior to installation, examine the areas and conditions under which the work is to be performed. Identify any conditions which will impact the proper and timely completion of the work. Do not proceed until the impacting conditions have been corrected.

F. Install electrical raceways, wiring and systems parallel and perpendicular to building surfaces and components to the extent possible. Equipment, boxes, etc. shall be installed level and plumb.

G. In general, run branch circuits in concealed above dropped ceilings, in furred walls, in voids and chases. All devices, conduits, wiring and conduits shall be recessed in new construction. In existing unfinished areas, such as mechanical spaces and storage areas wiring may be run exposed. In existing finished and public spaces where wiring cannot be practically concealed, such as block surfaces, wiring may be run in finished surface raceways secured using mechanically fastened clips.

H. Unless otherwise indicated, provide final connections to all equipment, in accordance with manufacturer's instructions.

3.02 SAFE WORK PRACTICES

A. To the greatest extent possible, all electrical work shall be performed on de-energized material and equipment using appropriate lock-out/tag-out procedures per OSHA requirements.

B. Work on energized systems shall be approved by the Owner's representative. All persons working on energized equipment shall wear appropriate personal protective equipment (PPE) following safe work practices and the latest version of NFPA 70E. A minimum of two people is required to be working to ensure the safety of each.

3.03 DELIVERY, STORAGE AND HANDLING OF MATERIALS

A. Comply with Division 01 requirements.

B. The Contractor shall arrange with the Owner for storage of delivered materials related to the work. Where the Owner cannot provide safe, adequate, or sufficient space, provide off-site storage or, with owner approval, arrange and pay for sufficient secure on-site storage container(s). Locations of storage containers shall be coordinated with the Owner.

C. The Electrical Contractor shall be responsible for coordinating, off-loading, receiving ang storing all deliveries related to the work. Coordinate all haul routes and schedules with the Owner or Construction Manager.

D. Products shall be delivered in manufacturer's original unopened packaging, with manufacturer's identification and product labelling.

E. Products shall be stored in a manner which shall protect them from theft, damage, weather and entry of debris. Comply with all manufacturer's written storage recommendations.

F. Promptly inspect delivered goods for damage and deficiencies. Arrange for their prompt replacement or removal from the site. Do not install damaged products.

3.04 COORDINATION AND COOPERATION

A. The work called for in the Contract Drawings Specifications shall be carried on in conjunction with the continued operation of the building. The work shall be arranged such that its installation and operation will conform with and facilitate the early installation of the work.

B. The Electrical Contractor shall bear the expense required to revise his work due to any failure to coordinate the installation of his work with that of the building's operation.

C. Unless otherwise stated in the Contract Drawings, all outages to building systems will occur when the building is not in use. The Electrical Contractor shall include all premium time charges in the bid.

D. The Electrical Contractor shall be responsible for the distribution and information concerning his work as required for the prompt installation. The Electrical Contractor will be held fully responsible for any delay in the work resulting from failure to distribute any information, etc. regarding his work as required. See also the applicable sections of the Conditions of the Contract.

E. The Electrical Contractor shall coordinate and cooperate with the Contractors of other trades, Subcontractors, outside agencies, and with the Owner regarding placement, anchorage and accomplishment of the work. Resolve interferences between work of other disciplines or Contractors, prior to commencing installation.

F. Coordinate with other trades for all demolition activities. Provide mark-outs for items to be demolished by others. De-energize and safe off circuits in demolition areas as required for a safe work area.

G. Coordinate with other trades and with Owner for chases, slots and openings during the project as required to complete the installation of the electrical work in timely manner.

H. Coordinate with other trades in scheduling all installation activities with the overall goal of completion of the project in a timely manner.

I. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

J. During the installation of equipment and raceways, provide any offsets, fittings, boxes, accessories to achieve changes in elevation or location as necessary to avoid obstacles and interferences, per actual field conditions.

K. Piping or other systems which are dependent upon slope have the right of way.

L. Provide temporary dust caps on smoke detectors in the work area as necessary to prevent false alarms. Remove when no longer required.

3.05 SHUTDOWNS

A. All shutdowns to existing electrical services are to be scheduled and approved, in advance, in writing, by the Owner. Unless otherwise noted, assume all temporary shutdowns to be performed while the building is not in operation. Include all premium time in bid. Include any applicable utility shutdown fees in bid.

3.06 DIMENSIONING

A. Refer to architectural or other dimensioned drawings. However, field measurements take precedence over dimensioned drawings. Do not scale drawings.

3.07 PROTECTION OF THE WORK

A. The Electrical Contractor shall effectively protect, at his expense, all materials and equipment, including his employees and building occupants, during the period of construction and shall be held responsible for all damage done to his work, until the same is fully accepted by the Architect. See also the applicable sections of the Conditions of the Contractor. Protect all electrical materials, equipment and work from the vandalism, weather elements, theft, paint overspray, concrete and mortar, construction debris and damage, etc. until acceptance by the Owner. Repair, replace and clean all electrical work so affected at no additional cost to the Contract.

3.08 CUTTING AND PATCHING

A. All cutting, core drilling, etc. required to facilitate the proper installation of all work to be installed under Electrical ids the responsibility of the Electrical Contractor, unless indicated otherwise. All cutting shall be done in the manner specified and/or directed and approved by the Engineer and only after permission of the Engineer is obtained. The installation of sleeves, chases, etc. in concrete walls, floors, ceilings, and roofs as well as the cutting of existing concrete walls, floors, ceilings, and roofs shall be done by core drilling. All patching will be the responsibility of this Contractor.

B. All penetrations to exterior walls and below grade foundations shall be made through sleeves provided by the Electrical Contractor and thoroughly sealed and caulked airtight and watertight.

C. Roof penetrations shall be performed via approved roof curbs, pitch pockets, pipe portals etc. Unless otherwise indicated, provide all required materials and labor to perform the penetration and subsequent repair. All penetrations shall be repaired and sealed airtight and watertight in accordance with existing roof warrantees and roof manufacturer directions. In no case shall any roof penetration or repairs violate existing warrantees.

D. Provide all new patching work to match existing conditions.

3.09 WATERPROOFING

A. Wherever any of the work of Division 26 must pierce any waterproofing, this work shall be done by the Electrical Contractor with care. After the part of these systems have been put in place through this waterproofing, the opening made by same shall be waterproofed and made absolutely water-tight as approved by the Architect and/or as hereinafter specified.

B. Conduits piercing the cement waterproofing of walls and floors shall be provided with waterproof conduit entrance seal sleeves around same. These sleeves shall be Type “WSK” (walls) or “FSK” (floors) as manufactured by O-Z or other approved.

C. Conduit sleeves through non-waterproofed, non-fire-rated walls and floors shall be grouted, caulked with oakum, and sealed with approved semi-plastic mastic compound on both sides of the wall.

D. All roof penetrations shall be performed in a manner to obtain watertight seal and in conformance with existing roof warrantees. Unless provided by others, provide pitch pockets, pipe portals or other means consistent with existing roof warrantees for any roof penetrations. Coordinate penetrations for rooftop HVAC equipment with the Mechanical Contractor.

3.10 FIRESTOPPING

A. Provide and apply listed firestopping materials to penetrations of fire-rated floor and wall assemblies for electrical installation. Firestopping shall restore original fire-resistance rating of assembly or better. Firestopping materials and installation requirements are specified in Section 078413 – Penetration Firestopping.

3.11 CEILING REMOVALS

A. Unless otherwise noted in the contract Documents, existing ceilings which must be removed for the Electrical Contractor’s installation or demolition work shall be done by the Electrical Contractor. No ceiling shall be removed without prior approval of the Owner. When directed by the Owner or Owner’s Representative, removed ceilings shall restored at the end of each working day. Ceilings which must be removed shall be restored to their original condition as soon as practical and prior to final payment.

B. Store any removed ceiling tiles either in the ceiling space or at a designated space in the building until re-installation.

C. Take all necessary precautions to prevent damage to the existing ceilings.

D. Replace Contractor damaged ceiling tiles with new ceiling construction to match the existing and to the Owner’s satisfaction.

E. Coordinate with other trades when ceiling related work must be performed in common work areas.

F. In areas with pre-existing ceiling damage, coordinate with the Owner’s representative to document said damage, and determine if the Owner wishes to provide replacement ceiling materials for re-installation.

3.12 PHASE ROTATIONS

A. The Electrical contractor is responsible to verify and maintain facility phase rotations throughout.

3.13 PAINTING AND FINISHING

A. Where final painting and finishes are not being provided by other trades, provide all priming and painting to cuts and patches performed under this Contract in finished areas to match existing conditions.

B. Provide matching painting and patching for surfaces in finished areas at locations of Electrical demolition and/or removals.

C. Provide matching painting and patching to building surfaces damaged as result of Electrical installation work.

D. Provide touch up painting to equipment furnished under this contract.

E. All painting materials shall conform to paint specifications elsewhere in the Contract Documents, or in the absence of same, shall be suitable for the surfaces and environments used. In no case shall lead based paints be used.

3.14 CHECKOUT, TESTING AND ADJUSTING

A. Provide all required programming, integration and adjustments, tune-ups. etc. as required to bring the equipment or system up to fully operational condition.

B. All tests required by the National Electrical Code, approved Electrical Inspection Agencies, State and Local Authorities, the servicing Utility Company, and the Engineer shall be executed by or paid for by the Electrical Contractor. Furnish all labor, material, and instruments for each test. All major tests shall be witnessed by the Engineer. Owner's representative and/or the Authority having jurisdiction, all of whom shall be given a minimum of one week's written notice prior to such tests.

C. Tests shall be scheduled at least one week in advance and at a time so as not to disrupt building operation, and to allow Engineer and Owner representative(s) the opportunity to witness the test, unless directed otherwise. Tests shall not be scheduled until the system installation is complete and fully operational, unless indicated or otherwise directed.

D. Where required by subsequent specification sections or by the manufacturer, arrange for and pay all costs for manufacturer's authorized representative(s) to be present at time of system or equipment start-up. The manufacturer's representative shall provide system integration and programming, start-up supervision, conduct and/or certify all required testing and adjusting, and provide any required training to the end user.

E. Coordinate with the Owner or his designated representative where Owner preferences or input is required for system setup.

F. Submit test reports neatly typewritten on 8-1/2 x 11" sheets indicating system or equipment being tested, date, and time of test, testing methodology, witnesses, testing results and any other pertinent information. Within five (5) days of test completion, submit written or electronic (PDF) copy of test reports for Engineer review, and include a copy with the appropriate operation and maintenance data.

G. At no additional cost, the Electrical Contractor shall correct any deficiencies found, and replace any defective materials and equipment or unable to perform at design or rated capacity. Repeat testing without additional cost to the Owner or Contract until satisfactory results are achieved. Submit final report indicating any corrective measures taken and satisfactory test results.

3.15 FINAL INSPECTIONS

A. Coordinate and obtain all final inspections as required by these specifications and as required by the Authority Having Jurisdiction. Obtain electrical inspection certificate from an authorized Electrical Inspection Agency. Include all costs in bid. Provide all inspection reports and Inspection certificates as part of closeout documents.

3.16 SYSTEMS DEMONSTRATION

A. The Electrical Contractor shall be fully responsible for instructing the Owner's designated personnel in the operation and maintenance of all equipment and systems furnished under the Contract. All costs required for such instruction and demonstration shall be paid for by the Electrical Contractor. Such instruction shall take place in the presence of the Owner's representative upon completion of the work. The Owner reserve the right to record any training sessions. Furnish for Owner use, Engineer approved, printed and bound copies of all operation and maintenance construction manuals. Included in these manuals shall be one (1) copy of all previously submitted and Engineer "Approved" or "Approved as Noted" shop drawings ("Approved as Noted" shop drawings must first be permanently corrected). Informal or non-Engineer witnessed instructions or instructions to non-designed Owner personnel shall not be recognized as fulfilling these requirements.

3.17 CLEANING

A. Perform cleaning in accordance with Division 01.

B. Maintain a clean work site. Remove from the premises, all packaging / shipping materials, waste, rubbish and construction debris. The premises shall be left clean and free of any debris and unused construction materials prior to final acceptance. Leave the area broom clean.

C. Clean all electrical equipment enclosures of dirt, dust, wire cuttings and other foreign materials.

D. Clean all light fixtures, lenses, reflectors and lamps of dirt, dust, fingermarks etc. Adjust lenses for proper fit.

E. Remove all temporary dust caps from fire alarm devices.

F. Provide touch-up painting to restore and refinish to match original condition surfaces of electrical equipment scratched, marred during shipping, handling or installation. Remove any rust and prime and paint as recommended by manufacturer. Pay particular attention to equipment installed outdoors in areas of harsh environment.

3.18 RECORD DOCUMENTS

A. Prior to final payment, submit Close Out Documentation in accordance with Division 01.

B. As-Built record drawings shall document installed locations of equipment, panelboards, disconnect switches and control devices. Document the approximate as-built routing of major feeders and underground conduit runs.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's standard catalog sheets, specifications, and installation instructions.

1.02 QUALITY ASSURANCE

A. Electrical components, conductors, devices and accessories described herein shall be listed and labeled as defined by NFPA 70 by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), for the intended use and shall bear its label.

PART 2 - PRODUCTS

2.01 INSULATED CONDUCTORS AND CABLES

A. Date of Manufacture: No insulated conductor more than one year old when delivered to the site will be acceptable.

B. Acceptable Companies: General Cable Corporation., Cerro Wire & Cable Co. Inc., Prysmian Cables & Systems, or Southwire Co or equal.

C. Conductors: Annealed uncoated copper or annealed coated copper in conformance with the applicable standards for the type of insulation to be applied on the conductor. Conductor sizes No. 8 and larger shall be stranded. Conductors No. 10 and smaller shall be solid.

D. Types:

1. Electric Light and Power Wiring:

a. Minimum conductor size is No. 12 AWG, unless indicated otherwise.
b. General: Rated 600V, NFPA 70 Type THHN/THWN-2 or XHHW-2.
c. THHN/THWN-2 Gasoline and Oil Resistant: Polyvinylchloride insulation rated 600 V with nylon jacket conforming to UL requirements for type THHN/THWN-2 insulation, with the words "GASOLINE AND OIL RESISTANT II" marked thereon.
d. USE-2: Dual rated heat and moisture resistant insulation rated 600 V with jacket or dual-purpose insulation/protective covering conforming to UL requirements for type USE-2 service entrance cables.
e. Metal-Clad Cable, NFPA 70 Article 330 Type MC:

1) Interlocked flexible galvanized steel armor sheath, conforming to UL requirements for type MC metal clad cable. Aluminum armored type MC cable is NOT permitted.
2) Insulated copper conductors, suitable for 600 volts, rated 90°C, one of the types listed in NFPA 70 Table 310.13(A) or of a type identified for use in Type MC cable.
3) Internal full size copper ground conductor with green insulation.
4) Acceptable Companies: AFC Cable Systems Inc., Southwire, General Cable.
5) Connectors for MC cable: AFC Fitting Inc.'s AFC Series, Arlington Industries Inc.'s Saddle grip, or Thomas & Betts Co.'s Tite-Bite with anti-short bushings.

f. MI: AFC Cable Systems' Type MI Cable, or Pentair Pyrotenax Mineral Insulated System 1850 Pyrotenax Cable:

1) Copper conductors.
2) Seamless copper sheath.
3) Two hour fire resistive rating UL system classified, listed in UL Building Materials Directory product category Electrical circuit Protective Systems (FHIT), or Fire Resistive Cables (FHJR).
4) Fittings and accessories as required for a complete system to suit listing and installation conditions.

2. Class 1 Wiring:

a. No. 18 and No. 16 AWG: Insulated copper conductors suitable for 600 volts, NFPA 70 types KF-2, KFF-2, PAFF, PF, PFF, PGF, PGFF, PTFF, SF-2, SFF-2, TF, TFF, TFN, TFFN, ZF, or ZFF.
b. Larger than No. 16 AWG: Insulated copper conductors suitable for 600 volts, in compliance with NFPA 70 Article 310.
c. Conductor with other types and thickness of insulation may be used if listed for Class 1 circuit use.

3. Class 2 Wiring:

a. Multiconductor Cables: NFPA 70 Article 725, Types CL2P, CL2R, CL2.
b. Other types of cables may be used in accordance with NFPA 70 Table 725.154(G) "Cable Substitutions", as approved.

4. Class 3 Wiring:

a. Single Conductors No. 18 and No. 16 AWG: Same as Class 1 No. 18 and No. 16 AWG conductors except that:

1) Conductors are also listed as CL3.
2) Voltage rating not marked on cable except where cable has multiple listings and voltage marking is required for one or more of the listings.

b. Multiconductor Cables: NFPA 70 Article 725, Types CL3P, CL3R, CL3.
c. Other types of cables may be used in accordance with NFPA 70, Table 725.154(G) "Cable Substitutions", as approved.

2.02 CONNECTORS

A. General:

1. Connectors specified are part of a system. Furnish connectors and components, and use specific tools and methods as recommended by connector manufacturer to form complete connector system.

2. Connectors shall be UL 486 A listed, or UL 486 B listed for combination dual rated copper/aluminum connectors (marked AL7CU for 75 degrees C rated circuits and AL9CU for 90 degrees C rated circuits).

3. Use of Split-Bolt type connectors is NOT permitted.

B. Splices:

1. Spring Type:

    a. Rated 105° C, 600V: Buchanan/Ideal Industries Inc.'s B-Cap, Electrical Products Div./3M's Scotchlok Type Y, R, G, B, O/B+, R/Y+, or B/G+, or Ideal Industries Inc.'s Wing Nuts or Wire Nuts.
    b. Rated 150° C, 600V: Ideal Industries Inc.'s High Temperature Wire-Nut Model 73B, 59B or equal.

2. Indent Type with Insulating Jacket:

    a. Rated 105° C, 600V: Buchanan/Ideal Industries Inc.'s Crimp Connectors, Ideal Industries Inc.'s Crimp Connectors, Penn-Union Corp.'s Penn-Crimps, or Thomas & Betts Corp.'s STA-KON.

3. Indent Type (Uninsulated): Anderson/Hubbell's Versa-Crimp oer equal, VERSAtile, Blackburn/T&B Corp.'s Color-Coded Compression Connectors, Electrical Products Div./3M's Scotchlok 10000, 11000 Series, Burndy's Hydent, Penn-Union Corp.'s BCU, BBCU Series, or Thomas & Betts Corp.'s Compression Connectors or equal.

4. Connector Blocks: NIS Industires Inc.'s Polaris System, or Thomas & Betts Corp.'s Blackburn AMT Series or equal.

5. Resin Splice Kits: Electrical Products Div./3M's Scotchcast Brand Kit Nos. 82A Series, 82-B1 or 90-B1, or Scotchcast Brand Resin Pressure Splicing Method or equal.

6. Heat Shrinkable Splices: Electrical Products Div./3M's ITCSN, Raychem Corp.'s Thermofit Type WCS, or Thomas & Betts Corp.'s SHRINK-KON Insulators or equal.

7. Cold Shrink Splices: Electrical Products Div./3M's 8420 Series or equal.

C. Gutter Taps: Anderson/Hubbell's GP/GT with GTC Series Covers, Blackburn/T&B Corp.'s H-Tap Type CF with Type C Covers, Burndy's Polytap KPU-AC, H-Crimpit Type YH with CF-FR Series Covers, ILSCO's GTA Series with GTC Series Covers, Ideal Industries Inc.'s Power-Connect GP, GT Series with GIC covers, NSI Industries Inc.'s Polaris System, OZ/Gedney Co.'s PMX or PT with PMXC, PTC Covers, Penn-Union Corp.'s CDT Series, or Thomas & Betts Corp.'s Color-Keyed H Tap CHT with HTC Covers or equal.

D. Terminals: Nylon insulated pressure terminal connectors by Amp-Tyco/Electronics, Electrical Products Div./3M, Burndy, Ideal Industries Inc., Panduit Corp., Penn-Union Corp., Thomas & Betts Corp., or Wiremold Co. or equal

E. Lugs:

1. Single Cable (Compression Type Lugs): Copper, one- or 2-hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, Electrical Products Div./3M Scotchlok 31036 or 31145 Series, Ideal Industries Inc.'s CCB or CCBL, NSI Industries Inc.'s L, LN Series, Penn-Union Corp.'s BBLU Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or equal.

2. Single Cable (Mechanical Type Lugs): Copper, one- or 2-hole style (to suit conditions); Blackburn/T&B Corp.'s Color-Keyed Locktite Series, Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Locktite Series or equal.

3. Multiple Cable (Mechanical Type Lugs): Copper, configuration to suit conditions; Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Color-Keyed Locktite Series or equal.

2.03 TAPES

A. Insulation Tapes:

1. Plastic Tape: Electrical Products Div./3M's Scotch Super 33+ or Scotch 88, Plymouth Rubber Co.'s Plymouth/ Bishop Premium 85CW.

2. Rubber Tape: Electrical Products Div./3M's Scotch 130C, or Plymouth Rubber Co.'s Plymouth/Bishop W963 Plysafe or equal.

B. Moisture Sealing Tape: Electrical Products Div./3M's Scotch 2200 or 2210, or Plymouth Rubber Co.'s Plymouth/Bishop 4000 Plyseal-V or equal.

C. Electrical Filler Tape: Electrical Products Div./3M's Scotchfil, or Plymouth Rubber Co.'s Plymouth/Bishop 125 Electrical Filler Tape or equal.

D. Color Coding Tape: Electrical Products Div./3M's Scotch 35, or Plymouth Rubber Co.'s Plymouth/Bishop Premium 37 Color Coding or equal.

E. Arc Proofing Tapes:

1. Arc Proofing Tape: Electrical Products Div./3M's Scotch 77, Mac Products Inc.'s AP Series, or Plymouth Rubber Co.'s Plymouth/Bishop 53 Plyarc.

2. Glass Cloth Tape: Electrical Products Div./3M's Scotch 27/Scotch 69, Mac Products Inc.'s TAPGLA 5066, or Plymouth Rubber Co.'s Plymouth/Bishop 77 Plyglas.

3. Glass-Fiber Cord: Mac Products Inc's MAC 0527 or equal.

2.04 WIRE-PULLING COMPOUNDS

A. To suit type of insulation; American Polywater Corp.'s Polywater Series, Electric Products Div./3M's WL, WLX, or WLW, Greenlee Textron Inc.'s, Cable Cream, Cable Gel, Winter Gel, Ideal Industries Inc.'s Yellow 77, Aqua-Gel II, Agua-Gel CW, or Thomas & Betts Corp.'s Series 15-230 Cable Pulling Lubricants, or Series 15-631 Wire Slick or equal.

2.05 WIRE MANAGEMENT PRODUCTS

A. Cable Clamps and Clips, Cable Ties, Spiral Wraps, etc: Catamount/T&B Corp., or Ideal Industries Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install conductors in raceways after the raceway system is completed.

B. No grease, oil, or lubricant other than wire-pulling compounds specified may be used to facilitate the installation of conductors.

3.02 CIRCUITING

A. Do not change, group, or combine circuits other than as indicated on the drawings.

B. Do not change, group, or combine circuits other than as indicated on the drawings except as permitted under Section 260532 when reusing existing raceways.

3.03 SEPARATE NEUTRAL CONDUCTOR

A. Provide a separate neutral conductor for each circuit. Use of common neutral for multiple circuits is NOT permitted.

3.04 CONDUCTOR SIZE

A. Conductor Size:

1. For Electric Light and Power Branch Circuits: Install conductors of size shown on drawings. Where size is not indicated, the minimum size allowed is No. 12 AWG.

2. Light and Power homeruns shall be #12 AWG size, unless otherwise noted. Where Light and Power homeruns exceed 100 feet as measured to nearest outlet or switch to panelboard, the homerun shall be upsized to #10 AWG.

3. For Class 1 Circuits:

a. No. 18 and No. 16 AWG may be used provided they supply loads that do not exceed 6 amps (No. 18 AWG), or 8 amps (No. 16 AWG).
b. Larger than No. 16 AWG: Use to supply loads not greater than the ampacities given in NFPA 70 Section 310.15.

4. For Class 2 Circuits: Any size to suit application.

5. For Class 3 Circuits: Minimum No. 18 AWG.

3.05 COLOR CODING

A. General:

1. Color coding for electric light and power conductors shall be by continuous colored insulation as described below.

2. Large Conductors: Conductors of sizes No. 4 AWG and larger may be furnished with black insulation and color coded with Vinyl Color Coding Tape at all accessible points.

B. Color Coding for 120/208 Volt Electric Light and Power Wiring:

1. Color Code:

a. 2 wire circuit - black, white.
b. 3 wire circuit - black, red, white.
c. 4 wire circuit - black, red, blue, white.

2. White to be used only for an insulated grounded conductor (neutral). If neutral is not required use black and red, or black, red and blue for phase to phase circuits.

a. “White” for Sizes No. 6 AWG or Smaller:

1) Continuous white outer finish, or:
2) Three continuous white stripes on other than green insulation along its continuous length.

b. “White” for Sizes Larger Than No. 6 AWG:

1) Continuous white outer finish, or:
2) Three continuous white stripes on other than green insulation along its continuous length, or:
3) Distinctive white markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install white color-coding tape at terminations, and at 1’ 0” intervals in gutters, pull boxes, and manholes.

3. Colors (Black, Red, Blue):

a. For Branch Circuits: Continuous color outer finish.
b. For Feeders:

1) Continuous color outer finish, or:
2) Color coding tapes encircling the conductors, installed on the conductors at time of their installation. Install color coding tapes at terminations, and at 1’ 0” intervals in gutter, pull boxes, and manholes.

C. Color Coding For 277/480 Volt Electric Light and Power Wiring:

1. Color Code:

a. 2 wire circuit – brown, gray.
b. 3 wire circuit – brown, yellow, gray.
c. 4 wire circuit – brown, yellow, orange, gray.

2. Gray to be used only for an insulated grounded conductor (neutral). If neutral is not required use brown and yellow, or brown, yellow and orange for phase-to-phase circuits.

a. “Gray” For Sizes No. 6 AWG or Smaller.

1) Continuous gray outer finish.

b. “Gray” For Sizes Larger Than No. 6 AWG:

1) Distinctive gray markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install gray color-coding tape at terminations, and at 1’ 0” intervals in gutters, pull boxes, and manholes.

c. Colors: (Brown, Yellow, Orange)
d. For Branch Circuits: Continuous color outer finish.
e. For Feeders:

1) Continuous color outer finish, or:
2) Color coding tapes encircling the conductors, installed on the conductors at the time of their installation. Install color coding tapes at terminations, and at 1’ 0” intervals in gutters, pull boxes, and manholes.

D. More Than One Nominal Voltage System Within A building: Permanently post the color-coding scheme at each branch-circuit panelboard.

E. Existing Color-Coding Scheme: Where an existing color-coding scheme is in use, match the existing color coding if it is in accordance with the requirements of NFPA 70.

F. Color Code for Wiring Other Than Electric Light and Power: In accordance with ICEA standard S-73-532 (NEMA WC57-2004). Other coding methods may be used, as approved.

3.06 WIRE MANAGEMENT

A. Use wire management products to bundle, route, and support wiring in junction boxes, pull boxes, wireways, gutters, channels, and other locations where wiring is accessible.

3.07 EQUIPMENT GROUNDING CONDUCTOR

A. Install equipment grounding conductor:

1. Provide an equipment grounding conductor for all circuits. Raceways shall not be relied upon as an equipment grounding conductor.
2. Where multiple circuits are grouped in a common raceway, a single equipment ground sized as per Code may be permitted.
3. Equipment grounding conductor shall be sized in accordance with the Contract Drawings. Where no size is indicated, provide minimum size equipment ground required by the Code.
4. Where conductors are upsized to account for voltage drop, the equipment grounding conductor shall be proportionally upsized per Code, whether or not indicated on the drawings.

B. Equipment grounding conductor is not intended as a current carrying conductor under normal operating circumstances.

C. Color Coding For Equipment Grounding Conductor:

1. Color Code: Green.

2. “Green” For sizes No. 6 AWG or Smaller:

   a. Continuous green outer finish, or:
   b. Continuous green outer finish with one or more yellow stripes, or:
   c. Bare copper (see exception below).

3. “Green” For Sizes Larger Than No. 6:

   a. Stripping the insulation or covering from the entire exposed length (see exception below).
   b. Marking the exposed insulation or covering with green color-coding tapes.
   c. Identify at each end and at every point where the equipment grounding conductor is accessible.

3.08 ARC PROOFING

A. Where indicted on the drawings, arc proof feeders installed in a common pull box or manhole as follows:

1. Arc proof new feeders.

2. Arc proof existing feeders that are spliced to new feeders.

3. Arc proof each feeder as a unit (except feeders consisting of multiple sets of conductors).

4. Arc proof feeders consisting of multiple sets of conductors by arc proofing each set of conductors as a unit.

5. Arc proof feeders with half-lapped layer of 55 mils thick arc proofing tape and random wrapped or laced with glass cloth tape or glass-fiber cord. For arc proofing tape less than 55 mils thick, add layers to equivalent of 55 mils thick arc proofing tape.

3.09 INSULATED CONDUCTOR AND CABLE SCHEDULE - TYPES AND USE

A. Electric Light and Power Circuits:

1. Type THHN/THWN-2 or XHHW-2. : Wiring in dry or damp locations (except where special type insulation is required).

2. THHN/THWN-2, XHHW-2, or USE-2: Wiring in wet locations (except where type USE-2 insulated conductors are specifically required, or special type insulation is required).

3. THHN/THWN-2: Wiring installed in existing raceway systems (except where special type insulation is required).

4. THHN/THWN-2 or XHHW-2: Wiring for electric discharge lighting circuits (fluorescent, HID), except where fixture listing requires wiring rated higher than 90° C.

5. THHN/THWN-2 Marked “Gasoline and Oil Resistant”: Wiring to gasoline and fuel oil pumps.

6. USE-2: Wiring indicated on the drawings to be direct burial in earth.

7. USE-2 Marked “Sunlight Resistant”:

   a. Service entrance wiring from overhead service to the service equipment.
   b. Wiring exposed to the weather and unprotected (except where special type insulation is required).

8. MC:

   a. Use of MC cable may be used in lieu of individual conductors in conduit, subject to the provisions of the NFPA 70 where run concealed above suspended ceilings and stud walls
   b. Branch circuit wiring in wood framed construction (wood joists and wood stud partitions):

      1) Install conductors parallel with joists or studs and attach to the side of these timbers by galvanized straps spaced not more than 6 feet apart.
      2) Install conductors through holes bored in the center of the timbers when running at right angles to joists or studs.
      3) Do not attach the conductors to the edge of joists or studs.

   c. Branch circuit wiring in movable metal partitions and movable gypsum partitions.

      1) Install conductors in accordance with partition manufacturer’s recommendations.

   d. Branch circuit wiring in metal stud partitions:

      1) Install conductors parallel with studs and attach to the side by galvanized straps spaced not more than 6 feet apart.
      2) Install conductors through holes bored in the center of the metal member when running at right angles to studs.

a) Conductors shall be protected by listed bushings or listed grommets covering all metal edges.

3) Do not attach the conductors to the edge of studs.

e. Concealed Above Ceilings: Subject to the provisions of NFPA 70. Support MC cable from building structure. Mc cable shall not be permitted to be supported by the ceiling grid.

9. MI:

a. Wiring for underplaster extensions.
b. Wiring in areas where indicated on drawings.
c. Where MI cable is installed in areas subjecting cable to corrosion, use PVC or HDPE jacketed MI cable (nonmetallic jacketed cable is not suitable for use in ducts, plenums or other spaces used for environmental air).

3.10 CONNECTOR SCHEDULE - TYPES AND USE

A. Temperature Rating: Use connectors that have a temperature rating, equal to, or greater than the temperature rating of the conductors to which they are connected.

B. Splices:

1. Dry Locations:

a. For Conductors No. 8 AWG or Smaller: Use spring type pressure connectors, indent type pressure connectors with insulating jackets, or connector blocks (except where special type splices are required).
b. For Conductors No. 6 AWG or Larger: Use connector blocks or uninsulated indent type pressure connectors. Fill indentions in uninsulated connectors with electrical filler tape and apply insulation tape to insulation equivalent of the conductor or insulate with heat shrinkable splices or cold shrink splices.
c. Gutter Taps in Panelboards: For uninsulated type gutter taps fill indentions with electrical filler tape and apply insulation tape to insulation equivalent of the conductor or insulate with gutter tap cover.

2. Damp Locations: As specified for dry locations, except apply moisture sealing tape over the entire insulated connection (moisture sealing tape not required if heat shrinkable splices or cold shrink splices are used).

3. Wet Locations: Use uninsulated indent type pressure connectors and insulate with resin splice kits, cold shrink splices or heat shrinkable splices. Exception: Splices above ground which are totally enclosed and protected in NEMA 3R, 4, 4X enclosures may be spliced as specified for damp locations.

C. Terminations:

1. For Conductors No. 10 AWG or Smaller: Use terminals for:

a. Connecting wiring to equipment designed for use with terminals.

2. For Conductors No. 8 AWG or Larger: Use compression or mechanical type lugs for:

a. Connecting cables to flat bus bars.
b. Connecting cables to equipment designed for use with lugs.

3. For Conductor Sizes Larger Than Terminal Capacity On Equipment: Reduce the larger conductor to the maximum conductor size that terminal can accommodate (reduced section not longer than one foot). Use compression or mechanical type connectors suitable for reducing connection.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260526 – GROUNDING AND BONDING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. Product Data: Manufacturer's standard catalog cuts for each type of product indicated.

B. Product Data: For the following:

1. Ground rods.
2. Grounding clamps & connectors

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

D. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Agency (NRTL) acceptable to authorities having jurisdiction and marked for intended use.

1. Comply with UL 467.

2. Comply with NFPA 70.

3. For overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

4. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy Corp.
2. Cadweld Div.; Erico Product, Inc.
3. Erico International Corporation
4. ILSCO
5. Joslyn Corp.
6. OZ Gedney Div.; General Signal Corp.
7. Thomas and Betts Corp.
8. Thompson Lightning Protection Corp.

2.02 GROUNDING CONDUCTORS

A. Insulated conductors, comply with Section 260519.

B. Material: Aluminum, copper-clad aluminum, and copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.03 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.04 GROUNDING ELECTRODES

A. Ground Rods: Pointed, Copper-clad steel.

1. Size: 3/4 x 120 inches

B. Test Wells: Where indicated, provide handhole as specified in Division 2 Section "Underground Ducts and Utility Structures."

PART 3 - EXECUTION

3.01 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

D. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

3.02 SERVICE GROUNDING

A. Provide a grounding electrode conductor, sized in accordance with the drawings or NFPA 70, connected to the neutral bus at the service disconnecting means and the opposite end connected to a listed grounding electrode.

B. Equipment grounding conductors shall be connected to the ground bus at the service disconnecting means.

C. Comply with NEC and local utility grounding requirements.

3.03 SEPARATELY DERIVED SYSTEM GROUNDING

A. Separately derived systems shall include, but are not limited to:

1. Transformers (exception: autotransformers)
2. Generators (where neutral is switched)
3. UPS systems when so configured.

B. Comply with NFPA 70.

C. A grounding electrode conductor, sized per the drawings or NFPA 70, shall be provided between the separately derived system grounded conductor and grounded metal frame or metal structural member. This connection shall be made at the source grounded conductor bus or at the first disconnecting means subject to the provisions of NFPA 70.

D. Provides system bonding jumper, sized per drawings or NFPA 70 between the system grounded conductor bus and the equipment ground bus.

E. There shall be no further connections between the grounded conductor and equipment ground downstream (load side) of the connection.

3.04 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all new feeders and branch circuits. Reliance solely on metallic raceways for equipment grounding means is NOT permitted.

C. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

D. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4- by-50-by-300-mm) grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

G. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.05 INSTALLATION

A. Ground Rods: Install ground rods per NEC and utility requirements.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds. Make connections without exposing steel or damaging copper coating.

3. Ground rods shall be installed in undisturbed earth.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

3.06 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.07 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section 310000. Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260529 – FASTENERS, ATTACHMENTS, AND SUPPORTING DEVICES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's standard catalog sheets, specifications and installation instructions.

B. Unless noted otherwise, specific manufacturer's and / or model / part numbers indicated in this specification section, shall be interpreted as that "manufacturer and/or model / part number" or equal.

PART 2 - PRODUCTS

2.01 ANCHORING DEVICES

A. Sleeve Anchors: Molly/Emhart's Parasleeve Series, Phillips' Red Head AN, HN, FS Series, or Ramset's Dynabolt Seriesl.

B. Wedge Anchors: Hilti's Kwik Bolt Series, Molly/Emhart's Parabolt Series, Phillips' Red Head WS, or Ramset's Trubolt Series.

C. Self-Drilling Anchors: Phillips' Red Head Series S or Ramset's Ram Drill Series.

D. Non-Drilling Anchors: Hilti's Drop-In Anchor Series, Phillips' Red Head J Series, or Ramset's Dynaset Series.

E. Stud Anchors: Phillips' Red Head JS Series.

2.02 CAST-IN-PLACE CONCRETE INSERTS

A. Continuous Slotted Type Concrete Insert, Galvanized:

1. Load Rating 1300 lbs./ft.: Kindorf's D-986.
2. Load Rating 2400 lbs./ft.: Kindorf's D-980.
3. Load Rating 3000 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-H.
4. Load Rating 4500 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-HD.

B. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded.

C. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept bolts having special wedge shaped heads.

2.03 MISCELLANEOUS FASTENERS

A. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work, selected from the following: Furnish galvanized fasteners for exterior use, or for items anchored to exterior walls, except where stainless steel is indicated.

1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
2. Lag Screws: ASME B18.2.1.
3. Machine Bolts: ASME B18.5 or ASME B18.9, Type, Class, and Form as required.

4. Wood Screws: Flat head, ASME B18.6.1.
5. Plain Washers: Round, ASME B18.22.1.
6. Lock Washers: Helical, spring type, ASME B18.21.1.
7. Toggle Bolts: Spring Wing Type; Wing AISI 1010, Trunion Nut AISI1010 or Zamac Alloy, Bolt Carbon Steel ANSI B18.6.3.

B. Stainless Steel Fasteners: Type 302 for interior Work; Type 316 for exterior Work; Phillips head screws and bolts for exposed Work unless otherwise specified.

2.04 TPR (THE PEEL RIVET) FASTENERS

A. 1/4 inch diameter, threadless fasteners distributed by Subcon Products, 315 Fairfield Road, Fairfield, NJ 07004 (800) 634-5979.

2.05 HANGER RODS

A. Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with nuts as required to position and lock rod in place. Unless galvanized or cadmium plated, provide a shop coat of red lead or zinc chromate primer paint.

2.06 "C" BEAM CLAMPS

A. With Conduit Hangers:

1. For 1 Inch Conduit Maximum: B-Line Systems Inc.'s BG-8, BP-8 Series, Caddy/Erico Products Inc.'s BC-8P and BC-8PSM Series, or GB Electrical Inc.'s HIT 110-412 Series.

2. For 3 Inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50W/B Series hangers, Kindorf's 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWB Series hanger.

3. For 4 Inch Conduit Maximum: Kindorf's E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger; Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger.

B. For Hanger Rods:

1. For 1/4 Inch Hanger Rods: B-Line Systems Inc.'s BC, Caddy/Erico Products Inc.'s BC, GB Electrical Inc.'s HIT 110, Kindorf's 500, 510, or Unistrut Corp.'s P1648S, P2398S, P2675, P2676.

2. For 3/8 Inch Hanger Rods: Caddy/Erico Products Inc.'s BC, Kindorf's 231-3/8, 502, or Unistrut Corp.'s P1649AS, P2401S, P2675, P2676.

3. For 1/2 Inch Rods: Appleton Electric Co. BH-500 Series, Kindorf's 500 Series, 231-1/2, OZ/Gedney Co.'s IS-500 Series, or Unistrut Corp.'s P1650AS, P2403S, P2676.

4. For 5/8 Inch Rods: Unistrut Corp.'s P1651AS beam clamp and P1656A Series anchor clip.

5. For 3/4 Inch Rods: Unistrut Corp.'s P1653S beam clamp and P1656A Series anchor clip.

2.07 CHANNEL SUPPORT SYSTEM

A. Channel Material: 12 gage steel.

B. Finishes:

1. Phosphate and baked green enamel/epoxy.
2. Pre-galvanized.
3. Electro-galvanized.
4. Hot dipped galvanized.
5. Polyvinyl chloride (PVC), minimum 15 mils thick.

C. Fittings: Same material and finish as channel.

D. UL Listed Systems:

1. B-Line Systems Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches).

2. Grinell Corp.'s Allied Power-Strut PS 200 (1-5/8 x 1-5/8 inches), PS 150 (1-5/8 x 2-7/16 inches), PS 100 (1-5/8 x 3-1/4 inches).

3. Kindorf's B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches).

4. Unistrut Corp.'s P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5000 (1-5/8 x 3-1/4 inches).

5. Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches).

2.08 MISCELLANEOUS FITTINGS

A. Side Beam Brackets: B-Line Systems Inc.'s B102, B103, B371-2, Kindorf's B-915, or Versabar Corp.'s VF-2305, VF-2507.

B. Pipe Straps:

1. Two Hole Steel Conduit Straps: B-Line Systems Inc.'s B-2100 Series, Kindorf's C-144 Series, or Unistrut Corp.'s P-2558 Series.

2. One Hole Malleable Iron Clamps: Kindorf's HS-400 Series, or OZ/ Gedney Co.'s 14-G Series, 15-G Series (EMT).

C. Deck Clamps: Caddy/Erico Products Inc.'s DH-4-T1 Series.

D. Fixture Stud and Strap: OZ/Gedney Co.'s SL-134, or Steel City's FE-431.

E. Supporting Fittings for Pendent Mounted Industrial Type Fluorescent Fixtures on Exposed Conduit System:

1. Ball Hanger: Appleton Electric Co.'s AL Series, or Crouse-Hinds Co.'s AL Series.

2. Flexible Fixture Hanger: Appleton Electric Co.'s UNJ-50, UNJ-75, or Crouse-Hinds Co.'s UNJ115.

3. Flexible (Hook Type) Fixture Hanger: Appleton Electric Co.'s FHHF, or Crouse-Hinds Co.'s UNH-1.

4. Eyelet: Unistrut Corp.'s M2250.

5. Eyelet with Stud: Kindorf's H262, or Unistrut Corp.'s M2350.

6. Conduit Hook: Appleton Electric Co.'s FHSN, or Crouse-Hinds Co.'s UNH-13.

F. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where specific fasteners are not specified or indicated for securing items to in-place construction, provide appropriate type, size, and number of fasteners for a secure, rigid installation.

B. Install anchoring devices and other fasteners in accordance with manufacturer's printed instructions.

C. Make attachments to structural steel wherever possible.

3.02 FASTENER SCHEDULE

A. Material:

1. Use cadmium or zinc coated anchors and fasteners in dry locations.

2. Use hot dipped galvanized or stainless steel anchors and fasteners in damp and wet locations.

3. For corrosive atmospheres or other extreme environmental conditions, use fasteners made of materials suitable for the conditions.

B. Types and Use: Unless otherwise specified or indicated use:

1. Cast-in-place concrete inserts in fresh concrete construction for direct pull-out loads such as shelf angles or fabricated metal items and supports attached to concrete slab ceilings.

2. Anchoring devices to fasten items to solid masonry and concrete when the anchor is not subjected to pull out loads, or vibration in shear loads.

3. Toggle bolts to fasten items to hollow masonry and stud partitions.

4. TPR fasteners to fasten items to plywood backed gypsum board ceilings.

5. Metallic fasteners installed with electrically operated or powder driven tools for approved applications, except:

a. Do not use powder driven drive pins or expansion nails.
b. Do not attach powder driven or welded studs to structural steel less than 3/16 inch thick.
c. Do not support a load, in excess of 250 lbs from any single welded or powder driven stud.
d. Do not use powder driven fasteners in precast concrete.

3.03 ATTACHMENT SCHEDULE

A. General: Make attachments to structural steel or steel bar joists wherever possible. Provide intermediate structural steel members where required by support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.

1. Make attachments to steel bar joists at panel points of joists.

2. Do not drill holes in main structural steel members.
3. Use “C” beam clamps for attachment to steel beams.

B. Where it is not possible to make attachments to structural steel or steel bar joists, use the following methods of attachment to suit type of construction unless otherwise specified or indicated on the drawings:

1. Attachment to Steel Roof Decking (No Concrete Fill):

    a. Decking With Hanger Tabs: Use deck clamps.
    b. Decking Without Hanger Tabs:

        1) Before Roofing Has Been Applied: Use 3/8 inch threaded steel rod welded to a 4 x 4 x 1/4 inch steel plate and installed through 1/2 inch hole in roof deck.
        2) After Roofing Has Been Applied: Use welding studs, or self-drilling/tapping fasteners. Exercise extreme care when installing fasteners to avoid damage to roofing.

2. Attachment to Concrete Filled Steel Decks (Total thickness, 2-1/2 inches or more):

    a. Before Fill Has Been Placed:

        1) Use thru-bolts and fish plates.
        2) Use welded studs. Do not support a load in excess of 250 pounds from a single welded stud.

    b. After Fill Has Been Placed: Use welded studs. Do not support a load in excess of 250 lbs. from a single welded stud.

3. Attachment to Cast-In-Place Concrete:

    a. Fresh Concrete: Use cast-in-place concrete inserts.
    b. Existing Concrete: Use anchoring devices.

4. Attachment to Cored Precast Concrete Decks:

    a. New Construction: Use thru-bolts and fish plates before Construction Work Contractor has placed concrete fill over decks.

5. Attachment to Waffle Type Concrete Decks:

    a. New Construction:

        1) Use cast-in-place concrete inserts in fresh concrete.

    b. If concrete fill has been applied over deck, thru-bolts and fish plates may be used where additional concrete or roofing is to be placed over the deck.

6. Attachment to Precast Concrete Planks: Use anchoring devices, except do not make attachments to precast concrete planks less than 2-3/4 inches thick.

7. Attachment to Precast Concrete Tee Construction:

    a. New Construction:

        1) Use tee hanger inserts between adjacent flanges.
        2) Use thru-bolts and fish plates, except at roof deck without concrete fill.

b. Existing Construction:

1) Use anchoring devices installed in webs of tees. Install anchoring devices as high as possible in the webs.

c. Do not use powder driven fasteners.
d. Exercise extreme care in drilling holes to avoid damage to reinforcement.

8. Attachment to Wood Construction: Use side beam brackets fastened to the sides of wood members to make attachments for hangers.

a. Under 15 lbs Load: Attach side beam brackets to wood members with 2 No. 18 x 1-1/2 inch long wood screws, or 2 No. 16 x 1-1/2 inch long drive screws.
b. Over 15 lbs Load: Attach side beam brackets to wood members with bolts and nuts or lag bolts. Do not use lag bolts in wooden members having a nominal thickness (beam face) under 2 inches in size. Install bolts and nuts or lag bolts in the side of wood members at the mid-point or slightly above. Install plain washers under all nuts.

LOAD	LAG BOLT SIZE	BOLT DIAMETER
15 lbs to 30 lbs	3/8 x 1-3/4 inches	3/8 inch
31 lbs to 50 lbs	1/2 x 2 inches	1/2 inch
Over 50 lbs to load limit of structure.	Use bolt & nut.	5/8 inch

c. Do not make attachments to the diagonal or vertical members of wood trusses.
d. Do not make attachments to the nailing strips on top of steel beams.

9. Attachment to Metal Stud Construction: Use supporting fasteners manufactured specifically for the attachment of raceways and boxes to metal stud construction.

a. Support and attach outlet boxes so that they cannot torque/twist. Either:

1) Use bar hanger assembly, or:
2) In addition to attachment to the stud, also provide far side box support.

3.04 CONDUIT SUPPORT SCHEDULE

A. Provide number of supports as required by National Electrical Code. Exception: Maximum support spacing allowed is 4'-0" for conduit sizes 3 inches and larger supported from wood trusses.

B. Use pipe straps and specified method of attachment where conduit is installed proximate to surface of wood or masonry construction.

1. Use hangers secured to surface with specified method of attachment where conduit is suspended from the surface.

C. Use "C" beam clamps and hangers where conduit is supported from steel beams.

D. Use deck clamps and hangers where conduit is supported from steel decking having hanger tabs.

1. Where conduit is supported from steel decking that does not have hanger tabs, use clamps and hangers secured to decking, utilizing specified method of attachment.

E. Use channel support system supported from structural steel for multiple parallel conduit runs.

F. Where conduits are installed above ceiling, do not rest conduit directly on runner bars, T-Bars, etc.

1. Conduit Sizes 2-1/2 Inches and Smaller: Support conduit from ceiling supports or from construction above ceiling.

2. Conduit Sizes Over 2-1/2 Inches: Support conduit from beams, joists, or trusses above ceiling.

3.05 LIGHTING FIXTURE SUPPORT SCHEDULE

A. General: Do not solely support fixtures from ceilings or ceiling supports unless it is specified or indicated on the drawings to do so Using one of the methods described below:

1. Support fixtures to structure using 12 Ga. Aircraft Cable. Wires need not be taught to allow for servicing for the fixture.

2. Support fixtures with hanger rods attached to beams, joists, or trusses. Hanger rod diameter, largest standard size that will fit in mounting holes of fixture.

   a. Where approved, channel supports may span and rest upon the lower chord of trusses and be utilized for the support of lighting fixtures.
   b. Where approved, channel supports may span and be attached to the underside of beams, joists, or trusses and be utilized for the support of lighting fixtures.

3. Use 2 nuts and 2 washers on lower end of each hanger rod to hold and adjust fixture (one nut and washer above top of fixture housing, one nut and washer below top of fixture housing).

   a. Where specified that an adequately supported outlet box is to support a fixture or be utilized as one point of support, support the box so that it may be adjusted to bring the face of the outlet box even with surface of ceiling.

4. Provide additional supports when recommended by the manufacturer.

B. Number of Supports For Ceiling Mounted Lighting Fixtures: Provide at least the following number of supports. Provide additional supports when recommended by fixture manufacturer or shown on the drawings.

1. Commercial and Industrial LED / Fluorescent Fixtures:

   a. Support individual fixtures less than or equal to 2 feet wide X 4’ long nominal at 2 points. In addition, lay in fixtures installed in suspended ceilings shall be secured to the grid using manufacturer’s recommended fixture securing clips.
   b. Support individual fixtures wider than 2 feet at 4 corners.
   c. Support continuous row fixtures less than 2 feet wide at points equal to the number of fixtures plus one. Uniformly distribute the points of support over the row of fixtures.
   d. Support continuous row fixtures 2 feet or wider at points equal to twice the number of fixtures plus 2. Uniformly distribute the points of support over the row of fixtures.
   e. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.

3.06 SPECIAL AREA CEILING MOUNTED EQUIPMENT

A. Provide safety tethers in addition to the standard mounting means for:

1. Lighting fixtures, ceiling speakers, ceiling projectors, etc. installed in Areas of Assembly and/or other high ceiling spaces such as Atriums, Gymnasiums, Natatoriums, Auditoriums, Cafeterias, etc.

2. Theatrical lighting fixtures.

3.07 CHANNEL SUPPORT SYSTEM SCHEDULE

A. Use channel support system where specified or indicated on the drawings.

B. Channel supports may be used, as approved, to accommodate mounting of equipment.

C. Material and Finish:

1. Dry Locations: Use 12 gage steel channel support system having any one of the specified finishes.

2. Damp Locations: Use 12 gage steel channel support system having any one of the specified finishes except green epoxy/enamel.

3. Wet Locations: Use 12 gage steel channel support system having hot dipped galvanized, or PVC finish.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260532 – RACEWAYS, FITTINGS AND ACCESSORIES

PART 1 – GENERAL

1.01 REFERENCES

A. NFPA, NEMA, ANSI, and UL.

1.02 SUBMITTALS

A. Product Data: Manufacturer's standard catalog sheets, specifications and installation instructions.

1.03 QUALITY ASSURANCE

A. Electrical components, conductors, devices and accessories described herein shall be listed and labeled as defined by NFPA 70 by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), for the intended use and shall bear its label.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Rigid Ferrous Metal Conduit (a/ka Galvanized Rigid Conduit (GRC)):

1. Comply with UL 6 and ANSI C80.1.

2. Minimum trade size – 3/4".

3. Provide steel, hot dipped galvanized on the outside and inside, UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit - Steel or Rigid Steel Conduit), by Allied Tube & Conduit Corp., Republic Conduit, or Wheatland Tube Co or approved equal.

B. Electrical Metallic Tubing (EMT):

1. Comply with UL 797 and ANSI C80.6.

2. Minimum trade size - 3/4".

3. Provide steel, galvanized on the outside and enameled on the inside, UL categorized as Electrical Metallic Tubing (identified on UL Listing Mark as Electrical Metallic Tubing), by Allied Tube & Conduit Corp Republic Conduit, or Wheatland Tube Co. or approved equal.

C. Flexible Metal Conduit (FMC):

1. Comply with UL 1.

2. Galvanized steel strip shaped into interlocking convolutions, UL categorized as Flexible Metal Conduit (identified on UL Listing Mark as Flexible Steel Conduit or Flexible Steel Conduit Type RW), by AFC Cable Systems Inc., Anamet Electrical Inc., Electri-Flex Co., or International Metal Hose Co. or approved equal.

D. Liquid-tight Flexible Metal Conduit (LFMC):

1. Comply with UL 360.

2. UL categorized as liquid-tight flexible metal conduit (identified on UL Listing Mark as Liquid-Tight Flexible Metal Conduit, also specifically marked with temperature and environment application data), by AFC Cable Systems Inc., Anamet Electrical Inc., Electri-Flex Co., or Universal Metal Hose Co. or approved equal.

E. Rigid Nonmetallic PVC Conduit (RNC), Fittings, and Accessories:

1. Comply with Nema TC2 and UL 651.

2. Minimum trade size – 3/4".

3. UL categorized as Rigid Nonmetallic, Schedule 40 and Schedule 80 PVC conduit (identified on UL Listing Mark as Rigid Nonmetallic Conduit Aboveground and Underground Schedule 40; Rigid Nonmetallic Conduit Aboveground and Underground Extra Heavy Wall Schedule 80), by Beck Mfg./Picoma Industries, Cantex Inc., Carlon/Div. Of Lamson and Sessions, Ipex Inc., National Pipe & Plastics Inc., or Queen City Plastics Inc or approved equal.

F. Surface Metal Raceway, Fittings and Accessories:

1. Comply with UL 5. By Thomas & Betts Corp., Mono-Systems Inc. or Wiremold Co.

2. Provide ivory color unless otherwise noted.

3. Provide minimum Wiremold 700 or equal for single power or data drops. Refer to Division 27 for wireway containing power and technology conductors. Follow manufacturer's recommended raceway capacity for all types and sizes of conductors.

2.02 FITTINGS AND ACCESSORIES

A. Insulated Bushings:

1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated throat; Appleton Electric Co.'s BU50I Series, Cooper/Crouse-Hinds' 1031 Series, OZ/Gedney Co.'s IBC-50 Series, Raco Inc.'s 1132 Series, Steel City/T & B Corp.'s BI-901 Series, or Thomas & Betts Corp.'s 1222 Series or approved equal.

2. Threaded malleable iron with 150 degrees C plastic throat; Appleton Electric Co.'s BU501 Series, Cooper/Crouse-Hinds' H1031 Series, or OZ/Gedney Co.'s IBC-50 Series.

B. Plastic Bushings for 3/4 Inch Conduit:

1. 105 degrees C minimum temperature rating; Appleton Electric Co.'s BBU50, BBU75, Blackburn (T & B Corp.'s) 50 BB, 75 BB, Cooper/Crouse-Hinds' 931,932, or OZ/Gedney Co.'s IB-50, IB-75, Raco Inc.'s 1402, 1403, Steel City/T & B Corp.'s BU-501, BU-502, or Thomas & Betts Corp.'s 222, 223 or approved equal.

2. 150 degrees C temperature rating; Appleton Electric Co.'s BBU50H, BBU75H, Cooper/Crouse-Hinds' H-931, H-932, or OZ/Gedney Co.'s A-50, A-75 or approved equal.

C. Insulated Grounding Bushings:

1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB-50 Series, Cooper/Crouse-Hinds' GLL Series, OZ/Gedney Co.'s IBC-50L Series, Raco Inc.'s 1212 Series, Steel City/T & B Corp.'s BG-801 (1/2 to 2") Series, or Thomas & Betts Corp.'s 3870 or approved equal.

2. Threaded malleable iron/zinc electroplate with 150 degrees C plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB Series, Cooper/Crouse-Hinds' HGLL Series, or OZ/Gedney Co.'s IBC-50L Series, or Thomas & Betts Corp.'s 3870or approved equal.

D. Connectors and Couplings:

1. Locknuts: UL, steel/zinc electroplate; Appleton Electric Co.'s BL-50 Series, Cooper/Crouse-Hinds' 11 Series, OZ/Gedney Co.'s 1-50S Series, Raco Inc.'s 1002 Series, Steel City/T&B Corp.'s LN-101 Series, or Thomas & Betts Corp.'s 141 Series or approved equal.

2. Grounding Wedge: Thomas & Betts Corp.'s 3650 Series or approved equal.

3. Couplings For Rigid Metal and IMC Conduit: Standard galvanized threaded couplings as furnished by conduit manufacturer, Allied Tube & Conduit Corp.'s Kwik-Couple, or Thomas & Betts Corp.'s Shamrock.

4. Three Piece Conduit Coupling For Rigid Metal and IMC Conduit: Steel, malleable iron, zinc electroplate; Allied Tube & Conduit Corp.'s Kwik-Couple, Appleton Electric Co.'s EC-50 Series, Cooper/Crouse-Hinds' 190M Series, OZ/Gedney Co.'s 4-50 Series, Raco Inc.'s 1502 Series, Steel City/T & B Corp.s EK-401 Series, or Thomas & Betts Corp.'s 675 Series.

5. Electrical Metallic Tubing Couplings and Insulated Connectors: Set screw type fittings are not permitted. Provide Compression type, steel/zinc electroplate; Appleton Electric Co.'s TW-50CS1, TWC-50CS Series, Cooper/Crouse-Hinds' 1650, 660S Series, Raco Inc.'s 2912, 2922 Series, Steel City/T & B Corp.'s TC-711 Series, or Thomas & Betts Corp.'s 5120, 5123 Series or approved equal.

6. Flexible Metal Conduit Connectors: Arlington Industries Inc.'s Saddle-Grip, OZ/Gedney Co.'s C-8T, 24-34T, ACV-50T Series, or Thomas & Betts Corp.'s Nylon Insulated Tite-Bite Series or approved equal.

7. Liquid-tight Flexible Metal Conduit Connectors: Steel, malleable iron, zinc electroplate, insulated throat; Appleton Electric Co.'s STB Series, Cooper/Crouse-Hinds' LTB Series, OZ/Gedney Co.'s 4Q-50T Series, Raco Inc.'s 3512 Series, Steel City/T & B Corp.'s LT-701 Series, or Thomas & Betts Corp.'s 5332 Series or approved equal.

E. Conduit Bodies (Threaded):

1. Malleable Iron/Zinc Electroplate: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds' Condulets, OZ/Gedney Co.'s Conduit Bodies, or Thomas & Betts Corp.'s Conduit Bodies. Or approved equal.

F. Expansion Fittings:

1. Malleable Iron, Zinc Electroplate Finish: Appleton Electric Co.'s XJ or OZ/Gedney Co.'s AX (TX for EMT), with external bonding jumper or approved equal.

2. Electrogalvanized Steel: Cooper/Crouse-Hinds' XJG (XJG-EMT for EMT), or Thomas & Betts Corp.'s XJG, with internal grounding or approved equal.

G. Deflection Fittings: Appleton Electric Co.'s DF, Cooper/Crouse-Hinds' XD, or OZ/Gedney Co.'s Type DX or approved equal.

H. Surface Metal Raceways: Use manufacturers approved fittings: couplings, ells, offsets, boxes etc. listed for use with ther raceway system. Match raceway finish.

I. Sealant for Raceways Exposed to Different Temperatures: Sealing compounds and accessories to suit installation; Appleton Electric Co.'s DUC, or Kwiko Sealing Compound with fiber filler, Cooper/Crouse-Hinds' Chico A Sealing Compound with Chico X fiber, Electrical Products Division 3M Scotch products, OZ Gedney Co.'s DUX or EYC sealing compound with EYF damming fiber, or Thomas & Betts Corp.'s Blackburn DX.

J. Vertical Conductor Supports: Kellems/Hubbell Inc.'s Conduit Riser Grips, or OZ/Gedney Co.'s Type M, Type R.

K. Pulling-In-Line For Installation in Spare and Empty Raceways: Polypropylene monofilament utility line; Greenlee Textron Inc.'s Poly Line 430, 431, or Ideal Industries Powr-Fish Pull-Line 31-340 Series.

PART 3 - EXECUTION

3.01 RACEWAY INSTALLATION - GENERAL

A. Install an equipment grounding conductor in all raceways. Raceway shall NOT be relied upon as an equipment ground conductor.

B. For New Work: Number of Raceways: Do not change number of raceways to less than the number indicated on the drawings.

1. Each raceway shall enclose one circuit unless otherwise indicated on the drawings.

C. For Rehab work. Number of Raceways: Do not change number of raceways to less than the number indicated on the drawings except when appropriate for advantageous reuse of existing exposed and concealed raceways (the contract documents do not indicate location, number, size or condition of existing raceways). Existing raceways may be reused if the following conditions are met:

1. The existing raceway must be of adequate size for the new conductors to be installed as per NFPA 70 Chapter 9, Tables 1, 4, & 5; Annex C, Tables C1-C12a. More circuits may be enclosed by existing raceways than the circuiting shown on the drawings provided conductor sizes are increased to compensate for derating (adjustment factors) and other considerations required by NFPA 70 Article 310-15.

2. Remove existing conductors.

3. Demonstrate to the Owner's Representative that the existing raceway is clear of obstructions and in good condition.

4. Check ground continuity. When ground continuity of existing raceway is inadequate install insulated grounding bushings, grounding wedges, bonding straps, grounding jumpers or equipment grounding conductors to establish effective path to ground.

5. Install insulated bushings to replace damaged or missing bushings. Replace non-insulated bushings with insulated bushings on raceway sizes 1 inch and larger.

6. Install vertical conductor supports to replace existing or missing vertical conductor supports.

7. Install extension rings on existing boxes when the number of new conductors installed therein exceeds NFPA 70 requirements.
8. Furnish the Owner's Representative with marked up drawings showing size and routing of existing raceways with number and size of new conductors installed therein. The drawings will be forwarded to the design engineer for verification of NFPA 70 compliance.

D. Raceways for Future Use (Spare Raceways and Empty Raceways): Draw fish tape through raceways in the presence of the Director's Representative to show that the raceway is clear of obstructions.

1. Leave a pulling-in line in each spare and empty raceway.

E. Conduit Installed Concealed:

1. Install conduit concealed unless otherwise indicated on the drawings.

2. Existing Construction:

a. Run conduit in existing chases and hung ceilings.
b. If conduit cannot be installed concealed due to conditions encountered in the building, report such conditions and await approval in writing before proceeding.

3. New Construction:

a. Run conduit in the ceilings, walls, and partitions.
b. Conduit may not be installed in concrete floor slab unless otherwise indicated on the plans. (concrete slabs that are both ceilings and floors shall be treated as floor slabs).
c. Where indicated on the drawings, install conduit in concrete slabs, under slabs on grade, or under slabs above finished ceilings where indicated on the drawings. Concrete slabs that are both ceilings and floors shall be treated as floor slabs.

1) Conduit in Slab: Run 3/4-inch conduit in the slab where placement of reinforcement and slab thickness is sufficient to allow 1-1/2 inches of concrete cover over conduit, otherwise run conduit under slab. Run conduit one inch and larger in the slab in the specific location(s) where it is indicated on the drawing to be run in the slab, otherwise run conduit under slab.

a) Run conduit under reinforcement where reinforcement is in upper portion or middle of slab.
b) Run conduit over reinforcement where reinforcement is in lower portion of slab.
c) Run conduit between reinforcement where reinforcement is in upper and lower portions of slab.
d) Separate parallel conduits minimum of 2 inches so that each conduit will be enveloped in concrete.
e) Pass conduit over steel beams, if any, parallel with the reinforcement.
f) Tie down conduit to avoid movement during placement of concrete.
g) Demonstrate to the Owner's Representative that conduit has been placed to allow minimum of 1-1/2 inches of concrete cover.

2) Conduit Under Slab on Grade:

a) Run conduit under vapor barrier, if any.
b) Install equipment grounding conductor in each conduit. Bond at boxes and equipment to which conduit is connected.

3) Conduit Under Slab, Above Finished Ceiling:

a) Attach conduit to bottom of slab or structure supporting the slab.
b) Firestop through-penetrations of the slab.

4. If any portions of the conduit system cannot be installed concealed due to conditions encountered in the building, report such conditions and await approval in writing before proceeding.

F. Conduits Penetrating Concrete Floor Slabs (Concrete slabs that are both ceilings and floors shall be treated as floor slabs):

1. Provide a minimum of 2 inches between conduits that vertically penetrate elevated concrete slabs.

2. Provide firestopping and spray on fireproofing at locations where conduits penetrate surface of floor slab and slab is part of fire rating required for construction.

G. Conduit Installed Exposed:

1. Install conduit exposed where indicated on the drawings.

2. Install surface metal raceway on existing block wall construction in finished areas.

3. Install conduit tight to the surface of the building construction unless otherwise indicated or directed.

4. Install vertical runs perpendicular to the floor.

5. Install runs on the ceiling perpendicular or parallel to the walls.

6. Install horizontal runs parallel to the floor.

7. Do not run conduits near heating pipes.

8. Installation of conduit directly on the floor will not be permitted.

9. Exposed conduits installed in finished area shall be painted by the Electrical Contractor to match surrounding areas. Exception – where general painting will be provided by other trades.

H. Conduit Size: **Not smaller than 3/4-inch electrical trade size**. Where type FEP, THHN, THWN, THWN-2, XHH, XHHW, or XHHW-2 conductors are specified for use under Section 260519, the minimum allowable conduit size for new Work shall be based on Type THW conductors.

I. Conduit Bends: For 3/4-inch conduits, bends may be made with manual benders. For all conduit sizes larger than 3/4 inch, manufactured or field fabricated offsets or bends may be used. Make field fabricated offsets or bends with an approved hydraulic bender.

3.02 RACEWAY INSTALLATION - SPECIAL AREAS

A. Raceways Exposed to Different Temperatures: Where portions of an interior raceway system are exposed to widely different temperatures, seal interior and exterior of raceway to prevent circulation of air from a warmer to a colder section through the raceway installation.

1. Refrigerated Rooms: Install conduit body or junction box in the raceway system on warm side of refrigerated room. After conductors are installed, seal interior of the raceway at the conduit body or junction box.

2. Heated Areas to Unheated Areas: After conductors are installed, seal interior of the raceway at the nearest conduit body, outlet or junction box in the heated area adjoining the unheated area.

B. Conduit for Prefabricated Walk-In Refrigeration Boxes:

1. Install box wiring in conduit. Run conduit exposed on exterior of box unless project conditions require conduit to be run exposed on interior of box.

   a. Install rigid ferrous metal conduit and galvanized fittings where the metal surfaces are galvanized steel.

2. Create a thermal break where penetrating the box by installing maximum of 12 inches of Schedule 40 high density polyethylene conduit within the conduit run at the penetration. Seal the penetration.

3. Install equipment grounding conductor in each conduit.

4. Seal raceway as specified for raceways exposed to different temperatures.

C. Conduits in Heating Tunnels: Install rigid ferrous metal conduit exposed in the tunnel and run conduit to avoid manhole entrances and other obstructions. Install equipment grounding conductor in each conduit.

D. Conduit in Waterproofed Floors: Install conduit runs in waterproof floors to avoid penetrating the waterproofing. Avoid penetration of waterproofing with conduit risers so far as practicable.

1. Where it is necessary to puncture the waterproofing for a conduit riser, install a standard weight steel pipe sleeve extending one inch above the finished floor level. Flash the steel pipe sleeve to the waterproofing with 16-ounce copper. Construct the flashing with a copper tube extending the full height of the sleeve, soldered to a copper base extending 6 inches in all directions from the sleeve.

2. The flashing will be integrated into the waterproofing by the Construction Contractor. Provide solid cast brass floor plates with chromium finish where pipe sleeves are exposed in rooms.

3.03 RACEWAY SCHEDULE

A. Rigid Ferrous Metal Conduit: Install in all locations unless otherwise specified or indicated on the drawings.

B. Electrical Metallic Tubing:

1. May be installed concealed as feeder or branch circuit conduits above suspended ceilings where conduit does not support fixtures or other equipment.

2. May be installed concealed as feeder or branch circuit conduits in hollow areas in dry locations, including:

   a. Hollow concrete masonry units, except where cores are to be filled.
   b. Drywall construction with sheet metal studs, except where studs are less than 3-1/2 inches deep.

3. May be installed exposed as feeder or branch circuit conduits in dry, unfinished, non-hazardous locations.

C. Flexible Metal Conduit: Install equipment grounding conductor in the flexible metal conduit and bond at each box or equipment to which conduit is connected:

1. Use for final conduit connection to recessed lighting fixtures in suspended ceilings. Use 4 to 6 feet of flexible metal conduit, minimum size 1/2 inch, between junction box and fixture. Locate junction box at least 1 foot from fixture and accessible if the fixture is removed.

2. Use 1 to 3 feet of flexible metal conduit for final conduit connection to:

   a. Emergency lighting units.
   b. Dry type transformers.
   c. Motors with open, drip-proof or splash-proof housings.
   d. Equipment subject to vibration (dry locations).
   e. Equipment requiring flexible connection for adjustment or alignment (dry locations).

3. Use for concealed branch circuit conduits above existing non-removable suspended ceilings where rigid type raceways cannot be installed due to inaccessibility of space above ceiling.

4. May be installed concealed as branch circuit conduits in drywall construction with sheet metal studs, except where studs are less than 3-1/2 inches deep.

D. Liquid-tight Flexible Metal Conduit: Install equipment grounding conductor in liquid-tight flexible metal conduit and bond at each box or equipment to which conduit is connected:

1. Use 1 to 3 feet of liquid-tight flexible metal conduit (UL listed and marked suitable for the installation's temperature and environmental conditions) for final conduit connection to:

   a. Motors with weather-protected or totally enclosed housings.
   b. Equipment subject to vibration (damp and wet locations).
   c. Equipment requiring flexible connection for adjustment or alignment (damp and wet locations).

E. Rigid Nonmetallic PVC Conduit:

1. Schedule 40 or Schedule 80 as indicated on the drawings.

   a. Use for protection of primary feeders within transformer vaults.
   b. Use for exterior branch circuits or feeders.
   c. Use underground or under slab feeders or branch circuits.

F. Surface Metal Raceway: Use as exposed raceway system in finished spaces with existing CM U or concrete construction or at locations indicated on the drawings.

1. Use surface metal raceway system of size required for number of wires to be installed therein. Use specific size when indicated on the drawings.

2. Do not run raceway through walls that have a plaster finish nor through masonry walls or floors. Install a pipe sleeve, or a short length of conduit with junction boxes or adapter fittings for raceway runs through such areas. Run raceway along top of baseboards, care being taken to avoid telephone and other signal wiring. Where raceway crosses chair railing or picture molding, cut the chair railing or picture molding to permit the raceway to lie flat against the wall.

Run raceway around door frames and other openings. Run raceway on ceiling or walls perpendicular to or parallel with walls and floors.

3. Secure raceway at intervals not exceeding 36 inches.

4. Install separate equipment grounding conductor for grounding of equipment. The raceway alone will not be considered suitable for use as an effective path to ground.

5. Outlet box covers for pendant mounted fluorescent fixtures may be omitted if the fixture canopy is notched to receive the raceway and the canopy fits snugly against the ceiling.

6. Where equipment is mounted on an outlet box and the equipment base is larger than the outlet box, provide finishing collar around equipment base and outlet box or provide finishing collar/outlet box:

    a. Finishing Collar: Same finish and peripheral dimensions as the equipment base, including provisions for mounting, slots to fit over raceway and of depth to cover outlet box and extend back to ceiling or wall.
    b. Combination Finishing Collar/Outlet Box: Same finish and peripheral dimensions as the equipment base to be mounted thereon, gage or thickness of metal as required by NFPA 70, including provision for mounting and knockouts for entrance of raceway.

G. Wireways: May be used indoors in dry locations for exposed raceway between grouped, wall mounted equipment.

3.04 FITTINGS AND ACCESSORIES SCHEDULE

A. General:

1. Use fittings and accessories that have a temperature rating equal to, or higher than the temperature rating of the conductors to be installed within the raceway.

2. Use zinc electroplate or hot dipped galvanized steel/malleable iron or cast iron alloy fittings and accessories in conjunction with ferrous raceways in dry and damp locations unless otherwise specified or indicated on the drawings.

3. Use insulated grounding bushings or grounding wedges on ends of conduit for terminating and bonding equipment grounding conductors, when required, if cabinet or boxes are not equipped with grounding/bonding screws or lugs.

4. Use caps or plugs to seal ends of conduits until wiring is installed to exclude foreign material.

5. Use insulated grounding bushings on the ends of conduits that are not directly connected to the enclosure, such as stub-ups under equipment, etc., and bond between bushings and enclosure with equipment grounding conductor.

6. Use expansion fittings where raceways cross expansion joints (exposed, concealed, buried).

7. Use deflection fittings where raceways cross expansion joints that move in more than one plane.

8. Use 2 locknuts and an insulated bushing on end of each conduit entering sheet metal cabinet or box in dry or damp locations.

    a. Plastic bushing may be used on 3/4 inch conduit in lieu of insulated bushing.
    b. Terminate conduit ends within cabinet/box at the same level.

B. For Rigid Metal Conduit: Use threaded fittings and accessories. Use 3 piece conduit coupling where neither piece of conduit can be rotated.

C. For Electrical Metallic Tubing: Use compression type connectors and couplings.
D. For Flexible Metal Conduit: Use flexible metal conduit connectors.

E. For Liquid-tight Flexible Metal Conduit: Use liquid-tight connectors.

F. For Rigid Nonmetallic PVC Conduit:

1. Use conduit manufacturer's standard fittings and accessories.

2. Provide expansion fittings for exterior conduits as required by NFPA 70.

G. For Surface Metal Raceway: Use raceway manufacturer's standard fittings and accessories. Match raceway finish color.

H. For Wireways: Use wireway manufacturer's standard fittings and accessories.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260534 – OUTLET JUNCTION AND PULL BOXES

PART 1 – GENERAL

1.01 REFERENCES

A. NEMA, and UL.

1.02 SUBMITTALS

A. Product Data: Manufacturer's standard catalog sheets, specifications and installation instructions.

1.03 QUALITY ASSURANCE

A. Electrical components, conductors, devices and accessories described herein shall be listed and labeled as defined by NFPA 70 by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), for the intended use and shall bear its label.

PART 2 - PRODUCTS

2.01 GALVANIZED STEEL OUTLET BOXES

A. Provide standard galvanized steel boxes and device covers in compliance with NEMA OS1 And UL 514A by Appleton Electric Co., Beck Mfg./Picoma Industries, Cooper/Crouse-Hinds, Raco/Div. of Hubbell, or Steel City/T & B Corp or approved equal.

2.02 GALVANIZED STEEL JUNCTION AND PULL BOXES

A. Provide code gage, galvanized steel screw cover boxes in compliance with NEMA OS1 by Delta Metal Products Inc., Hoffman Enclosures Inc., Hubbell Wiegmann, Lee Products Co., or Rittal/Electromate or approved equal.

2.03 THREADED TYPE BOXES

A. Outlet Boxes:

1. For Dry, Damp Locations: Provide zinc electroplate malleable iron or cast iron alloy boxes by Appleton Electric Co., Cooper/Crouse-Hinds Co., or OZ/ Gedney Co.,or approved equal, with zinc electroplate steel covers to suit application.

2. For Wet Locations: Provide malleable iron or cast iron alloy boxes with hot dipped galvanized or other specified corrosion resistant finish in compliance with NEMA FB1 as produced by Cooper/Crouse-Hinds (hot dipped galvanized or Corro-free epoxy powder coat), or OZ/Gedney Co. (hot dipped galvanized), with stainless steel cover screws, and malleable iron covers gasketed to suit application.

B. Junction And Pull Boxes:

1. For Dry, Damp Locations: Provide zinc electroplate cast iron boxes by Appleton Electric Co., Cooper/Crouse-Hinds, or OZ/Gedney Co., or approved equal with zinc electroplate steel or cast iron cover.

2. For Wet Locations: Provide cast iron boxes in compliance with NEMA FB1 and UL 1773 by Cooper/Crouse-Hinds' (hot dipped galvanized or Corro-free epoxy powder coat), or OZ/Gedney Co. (hot dipped galvanized), or approved equal, with stainless steel cover screws and cast iron cover gasketed to suit application.

C. Conduit Bodies, Threaded (Provided with a Volume Marking):

1. For Dry, Damp Location: Provide zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds' Condulets, or OZ/Gedney Co.'s Conduit Bodies or approved equal.

2. For Wet Locations: Provide malleable iron or cast-iron alloy bodies with hot dipped galvanized or other specified corrosion resistant finish; Cooper/Crouse-Hinds' Condulets (hot dipped galvanized or Corro-free epoxy power coat), or OZ/Gedney Co.'s Conduit Bodies (hot dipped galvanized) or approved equal, with stainless steel cover screws and malleable iron covers gasketed to suit application.

2.04 CORROSION RESISTANT BOXES

A. Plastic Coated Outlet and Junction Boxes: Provide threaded type malleable iron boxes coated with 40 mils thick polyvinylchloride coating; Ocal/T&B Corp.'s Ocal-Blue System, PCD Inc.'s KorKap, KorKap XL, or Robroy Industries' Plastibond or Perma-Cote System or approved equal.

B. Non-Metallic Junction and Pullboxes: Glass fiber reinforced polyester; Carlon/Div. of Lamon and Sessions' Himeline Series, Cooper/Crouse-Hinds' Krydon Products, or Robroy Industries' Stahlin Enclosures or approved equal.

2.05 SPECIFIC PURPOSE OUTLET BOXES

A. As fabricated by manufacturers for mounting their equipment.

2.06 FINISHING COLLAR OR COMBINATION FINISHING COLLAR/OUTLET BOX (SURFACE MOUNTED EQUIPMENT USED WITH EXPOSED RACEWAY)

A. Finishing Collar: Same finish and peripheral dimensions as the equipment base, including provisions for mounting, slots to fit over raceway and of depth to cover outlet box and extend back to ceiling or wall.

B. Combination Finishing Collar/Outlet Box: Same finish and peripheral dimensions as the equipment base, gage or thickness of metal as required by National Electrical Code, including provisions for mounting, and knockouts or threaded bosses for entrance of raceway.

2.07 FLOOR OUTLETS

A. For combination power and technology floor boxes and outlets – refer to Division 27.

B. Floor Outlet for Cast-In-Place Concrete Construction; Hubbell's Floor Boxes, Raco Inc.'s Tilt Top, or Steel City/T & B Corp.'s Floor Boxes:

1. Concrete tight galvanized steel boxes (for installation above grade).

2. Watertight cast iron boxes (for installation on or below grade).

3. Fully adjustable top (including 10-degree angular adjustment) before and after installation.

4. Service Fittings:

a. Above Floor: Aluminum, doghouse style, to suit power, service.
b. Flush Floor: Flush round cover with hinged lid (and carpet flanges for carpeted areas) to suit power service, finish to match hardware in area where installed.

2.08 OUTLET BOXES AND RELATED PRODUCTS FOR FIRE RATED CONSTRUCTION

A. For combination power and technology floor boxes and outlets – refer to Division 27.

B. Parameters For Use of Listed Metallic Outlet or Switch Boxes: UL Electrical Construction Equipment Directory - Metallic Outlet Boxes (QCIT).

C. Wall Opening Protective Materials: As listed in UL Fire Resistance Directory - Wall Opening Protective Materials (CLIV), or UL Electrical Construction Equipment Directory - Wall Opening Protective Materials (QCSN).

D. Floor Outlet Boxes:

1. Poke-Through System: As listed in UL Fire Resistance Directory - Outlet Boxes and Fittings Classified for Fire Resistance (CEYY), or UL Electrical Construction Equipment Directory - Outlet Boxes and Fittings Classified for Fire Resistance (QBWY).

2. Service Fittings:

a. Above Floor: Aluminum, doghouse style, to suit power service.
b. Flush Floor: Metallic flush round cover with hinged lid (and carpet flanges for carpeted areas) to suit power service, finish to match hardware in area where more installed.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide all boxes required to complete the raceway system, regardless of whether indicated or not on the drawings.

B. Provide boxes in sizes as required by Code.

C. Provide dividers in boxes where difference in insulation rating exceeds 300V.

3.02 PREPARATION

A. Before proceeding with the installation of junction and pull boxes, check the locations with the Owner's Representative and have same approved.

3.03 INSTALLATION

A. Mounting Position of Wall Outlets for Wiring Devices: Unless otherwise indicated, install boxes so that the long axis of each wiring device will be vertical.

B. Height of Wall Outlets: Unless otherwise indicated, locate outlet boxes with their center lines at the following elevations above finished floor:

Lighting Fixtures	6'-0"
Lighting Fixtures in Stairway	7'-6"

Exit Lights	8’-0” where ceiling height allows a minimum of 6 inch clearance between ceiling and top of exit light. Otherwise mount exit light so that it’s top is 6 inches below finished ceiling. Adjust height and clearances as required to suit installation over doors.
Night Lights	2’-0”
Hose Cabinet Lights	1’-0” above top of cabinet
Switches	4’-0”
Single & Duplex Receptacles	1’-6”*
Water Cooler Receptacles	2’-0”
Clock Receptacles	7’-6”
Range Receptacle	1’-6”
Special Purpose Receptacles	4’-0”
Thermostats	5’-0”
Manual Fire Alarm Boxes	4’-0”
Audible Notification Appliances	8’-0” where ceiling height allows a minimum of 6 inch clearance between ceiling and top of appliance. Otherwise mount appliance so that it’s top is 6 inches below finished ceiling.
Visible Notification Appliances	Install outlet so that the bottom of the visible lens will be 6’-8” AFF.
Combination Audible/Visible Notification Appliances	Install outlet so that the bottom of the visual lens will be 6’-8” AFF, and the audible section will be above the visible section.
Radio	2’-0”
Television	2’-0”
Telecommunications	2’-0”
Telephone	2’-0”
Wall Handset Telephone.	Install outlet so that the highest operable part of the wall mounted telephone will not be more than 4’-0” AFF.

*In areas containing heating convectors, install outlets above convectors at height indicated on drawings.

C. Supplementary Junction and Pull Boxes: In addition to junction and pull boxes indicated on the drawings and required by NFPA 70, provide supplementary junction and pull boxes as follows:

1. When required to facilitate installation of wiring.
2. At every third 90 degree turn in conjunction with raceway sizes over 1 inch.
3. At intervals not exceeding 100 feet in conjunction with raceway sizes over 1 inch.

3.04 OUTLET, JUNCTION, AND PULL BOX SCHEDULE

A. Boxes For Concealed Conduit System:

1. Non-Fire Rated Construction:

a. Depth: To suit job conditions and comply with NFPA 70 Article 370.
b. For Lighting Fixtures: Use galvanized steel outlet boxes designed for the purpose.

1) For Fixtures Weighing 50 lbs. or Less: Box marked “FOR FIXTURE SUPPORT”.
2) For Fixtures More Than 50 lbs: Box listed and marked with the weight of the fixture to be supported (or support fixture independent of the box).

c. For Ceiling Suspended Fans:

1) For Fans Weighing 35 lbs or Less: Marked “Acceptable for Fan Support.”
2) For Fans Weighing More Than 35 lbs, up to 70 lbs: Marked “Acceptable for Fan Support up to 70 lbs (or support fan independent of the box).”

d. For Junction and Pull Boxes: Use galvanized steel boxes with flush covers.
e. For Switches, Receptacles, Etc:

1) Plaster or Cast-In-Place Concrete Walls: Use 4 inch or 4-11/16 inch galvanized steel boxes with device covers.
2) Walls Other Than Plaster or Cast-In-Place Concrete: Use type of galvanized steel box which will allow wall plate to cover the opening made for the installation of the box.

2. Recessed Boxes in Fire Rated (2 hour maximum) Bearing and Nonbearing Wood or Steel Stud Walls (Gypsum Wallboard Facings):

a. Use listed single and double gang metallic outlet and switch boxes. The surface area of individual outlet or switch boxes shall not exceed 16 square inches.
b. The aggregate surface area of the boxes shall not exceed 100 square inches per 100 square feet of wall surface.
c. Securely fasten boxes to the studs. Verify that the opening in the wallboard facing is cut so that the clearance between the box and the wallboard does not exceed 1/8 inch.
d. Separate boxes located on opposite sides of walls or partitions by a minimum horizontal distance of 24 inches. This minimum separation distance may be reduced when wall opening protective materials are installed according to the requirements of their classification.
e. Use wall opening protective material in conjunction with boxes installed on opposite sides of walls or partitions of staggered stud construction in accordance with the classification requirements for the protective material.

3. Other Fire Rated Construction: Use materials and methods to comply with the listing requirements for the classified construction.

B. Boxes For Exposed Conduit System:

1. Dry and Damp Locations: Use zinc electroplate or hot dipped galvanized threaded type malleable iron or cast-iron alloy outlet, junction, and pull boxes or conduit bodies provided with a volume marking in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.

a. Galvanized steel boxes may be used in conjunction with conduit sizes over 1 inch in non-hazardous dry and damp locations.
b. Galvanized steel boxes may be used in conjunction with electrical metallic tubing where it is allowed (specified) to be installed exposed as branch circuit conduits at elevations over 10’-0” above finished floor.

2. Wet Locations: Use threaded type malleable iron or cast iron alloy outlet junction, and pull boxes or conduit bodies (provided with a volume marking) with hot dipped galvanized or other specified corrosion resistant coating in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.

a. Use corrosion resistant boxes in conjunction with plastic coated rigid ferrous metal conduit.

3. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Equipment Used With Exposed Raceway):

a. Use finishing collar where surface mounted equipment is installed on an exposed raceway outlet box and the equipment base is larger than the outlet box.
b. Use combination finishing collar/outlet box where surface mounted equipment is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into equipment body due to equipment design.

C. Specific Purpose Outlet Boxes: Use to mount equipment when available and suitable for job conditions. Unless otherwise specified, use threaded type boxes with finish as specified for exposed conduit system, manufacturer's standard steel (painted) boxes for surface metal raceway system and galvanized steel for recessed installations.

D. Stencil cover of pull boxes used on systems over 600 V, in white lettering minimum 1/2 inches high, the words "DANGER HIGH VOLTAGE - KEEP OUT".

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260543 – UNDERGROUND CABLE AND CONDUIT SYSTEMS

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 033000 – Cast-In-Place Concrete
C. Section 260519 – Low Voltage Electrical Power Conductors and Cables
D. Section 310000 – Earthwork

1.02 SUBMITTALS

A. Product Data: Manufacturer's standard catalog sheets, specifications and installation instructions.

B. Unless noted otherwise, specific manufacturer's and / or model / part numbers indicated in this specification section, shall be interpreted as that "manufacturer and/or model / part number" or equal.

1.03 QUALITY ASSURANCE

A. Electrical components, conductors, devices and accessories described herein shall be listed and labeled as defined by NFPA 70 by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), for the intended use and shall bear its label.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS

A. Conductors and cables:

1. Underground conductors, for electric light and power, rated 600V or less, whether direct buried or in conduit, shall be listed for use in wet locations and shall conform to the requirements of Section 260519.

2. Underground cabling, rated 601 volts and above, shall be as specified on he Contract Drawings, and shall meet the requirements of the serving utility, where applicable.

B. Rigid Ferrous Metal Conduit: Steel, galvanized on the outside and inside (conduit enameled on the inside will not be accepted), UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit-Steel or Rigid Steel Conduit), as manufactured by Allied Tube & Conduit Corp., LTV Steel Tubular Products Co., Triangle Wire & Cable Inc., or Wheatland Tube Co.

C. Rigid Nonmetallic Conduit and Fittings (Concrete Encased): Cantex, Inc.'s Schedule 40 or Schedule 80, Carlon Electrical Products Inc.'s Plus 40, CertainTeed Corp.'s Schedule 40, Omni/Opti-Com Manufacturing Network, Inc.'s Schedule 40 or Queen City Plastic Inc.'s Schedule 40 or Schedule 80.

D. Plastic Coated Rigid Metal Conduit, Fittings and Accessories: Rigid ferrous metal conduit, fittings

and accessories coated with 40 mils thick polyvinylchloride coating; Occidental Coating Co.'s Ocal 40, Protective Coatings Developments Inc.'s Kor-Kap, or Robroy Industries' Plastibond System.

E. Conduit Spacers and Levelers: Commercially manufactured type to suit conduit, installation and spacing requirements.

F. Duct Seal: Appleton Electric Co.'s DUC Weatherproof Compound, Manville Corp.'s Duxseal, OZ/Gedney Co.'s DUX, or Thomas & Betts Corp.'s DX.

G. Drag Line: Minimum 1/8-inch polypropylene monofilament utility rope; American Synthetic Ropes' Flotorope, Greenlee Tool Co.'s 2 ply Rope 431, or Thomas Industries/Jet Line Products' Rope 232.

H. Thru Wall Sealing Bushings:

1. For Walls Which Have or Will Have Membrane Waterproofing:

a. Cast-In-Place Installations: OZ/Gedney Co.'s Type FSK thruwall seal and Type FSKA membrane clamp adapter.
b. Core Drilled or Sleeved Installations: OZ/Gedney Co.'s Type CSM and Type CSMC with membrane clamp adapter.

2. For Walls Which Will Not Have Membrane Waterproofing:

a. Cast-In-Place Installations: OZ/Gedney Co.'s Type FSK.
b. Core Drilled or Sleeved Installations: OZ/Gedney Co.'s Type CSM, or Thunderline Corp.'s Link-Seal.

I. End Bells:

1. For Rigid Ferrous Metal Conduit: OZ/Gedney Co.'s Type TNS.

2. For Rigid Nonmetallic Conduit: Conduit manufacturer's standard end bells.

J. Insulated Grounding Bushings: Appleton Electric Co.'s GIB-50 Series, Crouse Hinds GLL Series, OZ/Gedney Co.'s IBC-50L Series, Raco Inc.'s 1212 Series, or Thomas & Betts Corp.'s 3870 or BG Series.

K. Underground Warning Tape:

1. Aluminum backed, 6-inch wide by 0.005-inch-thick underground warning tape with a Red background color (electric) or orange background color(telecommunications)as applicable.

2. Black lettering “CAUTION – BURIED ELECTRIC LINE BELOW” or “CAUTION – BURIED TELECOMMUNICATIONS LINE BELOW” as applicable.

2.02 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers:

a. Armorcast Products Company
b. Carson Industries LLC
c. Oldcastle
d. Quazite: Hubbell Power Systems, Inc.

B. Standard: Comply with ANSI/SCTE 77.

C. Minimum design loads: Unless otherwise noted, minimum design loads shall meet ANSI/SCTE/77 Tier 22 Ratings: 22,500 lbs vertical design load and 800 lbs/sq.ft. lateral, tested at 150% Of the design loads.

D. Color of Frame and Cover: Gray.

E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, "ELECTRIC."

I. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

J. Provide divider to separate wiring with insulation levels exceeding 300V.

PART 3 - EXECUTION

3.01 PREPARATION

A. Obtain all required utility markouts as per State / Local Laws and Codes and as specified elsewhere in the project specifications. Maintain markings until no longer required.

B. Prior to installing any Work, lay out the proposed course for the conduits, location of manholes, etc. and have same approved by the Owner's Representative.

3.02 UNDERGROUND CONDUIT INSTALLATION

A. Spacing:

1. Arrangement for Power and Signal Service: Separate power system conduits from signal system conduits with minimum 6 inches thick concrete wall or 12 inches of earth.

2. Conduit Bank: Separate individual conduits a minimum of 3 inches. Use spacers and levelers located no more than 8 feet apart. Separators between tiers shall be staggered approximately 6 inches between tiers.

B. Depth:

1. Light and Power Cabling rated 600V and Below, Telecommunications, Fiber Optic, and other Low Voltage systems: Unless otherwise indicated or directed, install conduit at least 24 inches below finished grade to top of highest conduit.

2. Electric Light and Power Cabling Rated 601V and Higher: Unless otherwise indicated or directed, install conduit at least 36 inches below the finished grade to top of the conduit.

3. Crossing Obstructions: Use rigid ferrous metal conduit where top of conduit system is less than 18 inches below finished grade when crossing obstructions (heating tunnels, etc.).

4. In Rock:

    a. Unless otherwise indicated on the drawings install rigid ferrous metal conduit or concrete encased rigid nonmetallic conduit at depths previously specified. Backfill with suitable material in accordance with SECTION 310000 - EARTHWORK.
    b. Where conduit is indicated to be installed at lesser depths, use rigid ferrous metal conduit. Cover conduit with minimum 2 inches of concrete. In exposed rock area fill trench with concrete to surface level of rock. Where rock is not exposed, complete backfill in accordance with SECTION 310000 - EARTHWORK.

C. Pitch:

1. Pitch conduit away from buildings.

2. Pitch conduit toward manhole a minimum of 3 inches per 100 feet. On runs where it is impossible to maintain the grade all one way, grade from center so that conduits pitch both directions down toward manholes.

D. Concrete Encasement for Rigid Non-Metallic Conduit Using Either of the Two Methods Indicated Below: (Concrete Encasement for Rigid Ferrous Metal Conduit is not Required):

1. Single Pour Method:

    a. Concreting Sequence: Pour each run of envelope between handholes or other terminations in one continuous operation.

        1) Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations or use other specific measures to prevent expansion-contraction damage.
        2) If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

    b. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in the middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
    c. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
    d. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
    e. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

        1) Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.
        2) Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

2. Two Pour Method:

a. Lay rigid nonmetallic conduits on a continuous concrete footing not less than 3 inches thick and as wide as the encasement. Install footings straight and true both in line of run and transversely and finished with an even surface. Incorporate anchoring devices into the footing for use in tying down the conduits. Grade footings so that conduits maintain required pitch. Before installing spacers, levelers, and conduits, let concrete footings harden as required to prevent damage to the footings.

1) Where conduits enter building or manhole wall, reinforce footings for 10 feet with No. 4 rods, 4 inches on center.
2) Footings are not required for rigid ferrous metal conduit.

b. After rigid nonmetallic conduits have been laid on footing with spacers and levelers (located no more than 8 feet apart), tie conduits down to the footing, then surround the conduits by concrete not less than 2 inches thick on top and 2 inches on each side. Separate individual conduits a minimum of 3 inches so that each conduit is completely enveloped in concrete.

1) Where conduits enter building or manhole walls, reinforce encasement for 10 feet with No. 4 rods, 4 inches on center.
2) Encasement is not required for rigid ferrous metal conduit.

c. Form sides of the concrete encasement. Exception: Earth cuts will be permitted as the form where trenches are neatly excavated in stable soils.

E. Jacking Conduits: Rigid ferrous metal conduit may be jacked under roads, parking lots, etc. Submit jacking details for approval.

F. Conduits Entering Buildings and Manholes:

1. Seal conduit entrances into manholes watertight.

2. Seal conduit entrances into building walls watertight. Exception: Seal is not required in below grade foundation walls associated with slab on grade construction.

3. Install end bells at conduit entrances into manholes.

4. Install end bells at conduit entrances into buildings. Exceptions:

a. Install insulated grounding bushing on conduit entrance stub up associated with slab on grade construction.
b. Install insulated grounding bushing and 2 locknuts on conduit where conduit is terminated in cabinet, junction or pull box.

G. Cleaning Conduits: Take precautions to prevent foreign matter from entering conduits during installation. After installation clean conduits with tools designed for the purpose.

H. Conduit for Future Use (Spare Conduit and Empty Conduit): Demonstrate to the Owner's Representative that conduits installed for future use are clear of obstructions (draw mandrel 1/2 inch less in diameter than conduit). Install a drag line in each conduit.

I. Sealing Ends of Conduits:

1. Occupied Conduits: Seal ends of conduits to be used for Work of this contract until cables are to be installed. After cable installation, seal conduits at building entrances and first manhole outside building. Seal with duct seal.

2. Conduits For Future Use: Seal the ends of spare and empty conduits at building entrances

and manholes. Seal with plastic plugs or a contrasting color cement/sand mixture.

J. Using Existing Underground Conduits: Clean the conduits with tools designed for the purpose. The condition of conduits after cleaning may be determined with a mandrel 1/2 inch less in diameter than the conduit, with the sheath painted with black lacquer. Pull mandrel through conduit. Conduit is acceptable when there are no roller marks or scratches on the mandrel. Other methods may be used if approved. Report and demonstrate to the Director's Representative any defect found in the conduit system that cannot be eliminated. The Contractor is held responsible for any damage to cables resulting from imperfections in the conduit.

K. Underground Warning Tape:

1. Apply over all direct buried cable and underground conduit runs.

2. Run tape parallel to, and 12” above, cable or conduit run centerline.

3. Where ductbank exceeds 18” inches in width, provide additional tape runs 12” apart for each additional 12” in width.

L. Cable Installation:

1. Grounding: Provide an equipment ground conductor, sized per Contract Drawings or NFPA 70 (whichever is greater), in all new underground electric light and power cable runs. Do NOT rely on metallic conduits or cable armor to serve as equipment ground.

2. Cable Pulling: Clean conduits prior to installation of cables as described herein. Do not exceed manufacturer’s recommended maximum pulling tensions.

3. Underground Cable Splices:

a. Underground cables splices shall be made only where called for on the drawings, cable taps, or where otherwise absolutely necessary. Pull through intermediate handholes/ manholes.
b. Use only splice kits listed for underground use.
c. Splices shall be made in approved handholes / manholes only. Direct buried splices or splices pulled into conduits are NOT permitted.

3.03 CONDUIT SCHEDULE - TYPES AND USE

A. Rigid Ferrous Metal Conduit: Install in all locations unless otherwise specified or indicated on the drawings.

B. Rigid Nonmetallic Conduit (Concrete Encased): May be installed in all locations except:

1. Where conduit stubs up or rises through slab or finished grade.

2. Where other type raceways are specified or indicated on the drawings.

C. Rigid Nonmetallic Conduit (Direct Buried) Schedule 80 PVC: May be Installed in all locations unless otherwise specified or indicated on the drawings.

D. Rigid Nonmetallic Conduit (Direct Buried) Schedule 40 PVC: May be installed in unpaved areas when so specified in the drawings.

3.04 HANDHOLE INSTALLATION

A. Do NOT install polymer concrete handholes in areas subject to deliberate vehicular traffic unless specifically rated and listed for this use.

B. Handholes and boxes shall be set level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Provide box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

C. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

D. In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, non-deliberate, heavy- vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame.

   1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 033000 "Cast-in- Place Concrete," with a troweled finish.

   2. Dimensions: 10 inches wide by 12 inches deep.

3.05 RESTORATION

A. Backfill, compact and restore trench to final or existing grades as per Contract Drawings and as per Section 31000 – Earthwork.

B. Seed// sod grassy areas as per Section 31000 – Earthwork.

C. Where final grading and paving are NOT being performed by other trades:

   1. Restore all disturbed paving to match adjacent existing conditions or better.

   2. Restore disturbed concrete walk flags in their entirety. Match adjacent grades.

   3. Restore disturbed curbing to match adjacent curbing.

   4. Restore any disturbed traffic and paving markings.

   5. Paved areas shall be swept clean of all spoils and debris removed from site.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. All sections of the project manual are directly applicable to this specification section. Should a conflict arise between specification sections or between specifications and drawings and/or code requirements, the contractor shall notify the Architect/Engineer of the conflict in writing. If direction is not provided prior to the submission of the bid, the contractor shall price the more extensive system.

1.02 SUMMARY

A. Clearly and properly identify the complete electrical system to indicate the loads served or the function of each item of equipment connected under this work.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145 for danger, caution or safety instruction signs.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.02 LABELS

A. Pre-Printed: Permanent material pre-printed with black on white, with adhesive backing. Brady, 3M, or equal.

B. Laminated Plastic: 3-ply laminated plastic, color as indicated, with 1/2-inch high white letters for low voltage. Lamicoid, or equal.

C. Identification Plates: Engraved Phenolic/Lamacoid plastic, 1/16” thick, ASTMD 709 Type 1, black with white letters or white with black letters.

D. Plastic Tape: Black or red with white letters, adhesive backing, field-printed with proper tool. Dymo-tape, or equal.

E. Marker Tape: Clear adhesive-backed tape with black letters, for device plates. Kroy, or equal.

F. Wire Markers: White with black numbers, adhesive-backed tape on dispenser roll. Brady, 3M, or equal.

G. Marker Pen: Black permanent marker suitable for writing on metallic surfaces.

2.03 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 7 by 10 inches.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlton Industries, LP
   b. Champion America
   c. Marking Services, Inc.
   d. Approved Equal.

B. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.

2. Thickness:

   a. For signs up to 20 sq. inches, minimum 1/16-inch-.
   b. For signs larger than 20 sq. inches, 1/8 inch thick.
   c. Engraved legend with colors as indicated below by type of service:

      1) Normal Power – Black background with white letters.
      2) Standby Power- Blue background with white letters.
      3) Emergency/Life Safety Power- Red background with white letters.
      4) UPS/Clean Power – Gray background with white letters to read “UPS POWER” or “CLEAN POWER.”

   d. Punched or drilled for mechanical fasteners.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Brady Corporation
   b. Carlton Industries, LP
   c. Marking Services, Inc.
   d. Approved Equal

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, #404 stainless-steel screws.

PART 2 – EXECUTION

3.01 GENERAL

A. Prior to applying adhesive identification products, clean and prepare surfaces as recommended by manufacturer of identification product.

B. Verify each item to be identified prior to application. Verify and coordinate all labelling information, colors etc. with the Drawings, Shop Drawings, manufacturer's wiring diagrams and manuals etc. and any special Owner labelling requirements. Labelling shall be consistent throughout Project.

C. Install any labelling prior to installing acoustical ceilings or other concealment.

D. Apply identification devices to surfaces that require finish after completion of finish work.

E. Identification materials and devices shall not interfere with operation and maintenance of equipment.

F. Attach signs and plastic labels that are not self-adhesive type with stainless steel mechanical fasteners appropriate to the location and substrate.

G. Wraparound Marker Labels and Metal Tags shall be secured tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Labeling Instructions:

1. Indoor Equipment: Non-ferrous metal or rigid plastic, stamped, embossed or engraved identification plates shall have white letters on black face or vice versa. Unless otherwise indicated, provide a single line of text with 1/8-inch- high letters on 1-1/2-inch- high label; where multiple lines of text are required, increase height accordingly.

2. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

3. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

4. Labels not using self-adhesive attachment, shall be fastened using appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

3.02 IDENTIFICATION SCHEDULE

A. General

1. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

   a. Comply with 29 CFR 1910.145.
   b. Identify system voltage with black letters on an orange background.
   c. Apply to exterior of door, cover, or other access.
   d. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

      1) Power-transfer switches.
      2) Controls with external control power connections.

2. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
3. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

B. Low Voltage Switchgear

1. Label each switchgear section with laminated plastic label indicating switchgear name and section per the drawings / shop drawings, ampere rating, voltage. Indicate source from switch switchboard is fed and feeder size on incoming feeder section.

2. Label all protective devices with laminated plastic labels indicating the function or the load served.

3. Provide laminated plastic labels for all bussed spaces indicating the maximum ampere rating or size of future breaker or switch that may be installed in the space reserved.

C. Branch Circuit and Power Distribution Panelboards:

1. Provide laminated plastic labels on panel exterior which indicate panel name per the drawings, voltage, source, from which the panel is fed with laminated plastic labels attached to face trim. Indicate feeder source, feeder wire size, and feeder breaker or fuse size with marker tape or marker pen on the inside of the panel door.

2. For new or modified panelboards, provide typewritten or software generated panel directories, with protective, clear transparent covers, accurately accounting for every breaker installed, including spares. Schedules shall use the actual loads and room designations assigned by name or number near completion of the work. Do not use the designations from the drawings.

3. For power distribution panelboards, where no directory is present, label each protective device with laminated plastic labels indicating load served. Marker pen is permitted where space does not permit laminated plastic labels.

D. Motor Control Centers:

1. Label all motor control centers with laminated plastic labels indicating control center name per the drawings.

2. Label all starters and breakers with factory-provided labels or laminated plastic labels indicating the function or the load served and location.

3. Provide pre-printed labels for all spaces.

E. Transformers:

1. Label all transformers with identification plate indicating equipment label per the drawings, KVA, primary and secondary voltages, source, and load served.

F. Disconnect Switches

1. Label All Disconnect Switches with laminated plastic labels indicating device name per the drawings, and with permanent marker, the source, load served, and internal fuse size, if applicable.

G. Miscellaneous Equipment

1. Label all motor start switches, individual circuit breakers, relays, contactors, time switches, and indicating equipment with marker tape or laminated plastic labels indicating equipment number, source, and circuit number.

2. Where the controlling device is remote mounted from the serving panel, include the serving panel designation and circuit number with additional plastic tape labels.

H. Receptacles

1. All receptacle plates shall be marked in marker tape on the face of the plate, with the receptacles panel and branch circuit designation. The identification shall be made with clear self-adhesive tape with black 10-point letters. Apply the tape at the top of the device plate.

2. Receptacles connected to a GFCI-protected circuit downstream from the protecting device shall be labeled “GFCI Protected.”

I. Outlet, Pull, And Junction Boxes

1. For exposed and those above suspended ceilings, label covers of power junction boxes neatly by hand using permanent marker, indicating source and circuit number.

2. For exposed ceilings in occupied public spaces, where conduits, junction boxes, etc. are to painted to blend into the ceiling, provide aforementioned labelling on the inside cover of the junction box.

J. Conduits

1. Label all exposed conduit runs in non-public spaces or accessible ceiling spaces with source panel and circuit number using neatly written using permanent marker. Include destination in labelling for all feeder conduits Space labels a maximum of 50 feet apart and at least one per room. Label conduits at entrances of all “J” boxes, distribution panels, MCC, panelboards, etc.

2. Omit labelling exposed conduits in occupied public spaces.

K. Emergency Lighting Fixtures:

1. Ceiling mounted and wall mounted emergency light which are equipped with integral emergency back-up battery or are tied into an emergency power system (emergency generator, remote inverter, etc.), shall be readily identified with a ¾” dia. red circular adhesive label either on the fixture or on the ceiling grid surrounding the fixture.

2. Exceptions:

   a. Twin head battery pack emergency unit fixtures and
   b. Fixtures equipped with integral emergency battery with an indicator LED clearly visible without removing any lensing.

L. Special Systems (Fire Alarm, Security, Pa, Etc.): subject to the provisions of the respective specification section for each system:

1. Equipment Cabinets, Terminal Cabinets, Power Supply Cabinets, Control Panels, Patch Panels, Racks:

   a. Provide identification plates with equipment identification as indicated on the drawings.

b. Label termination blocks and ports.

2. Pullboxes, Enclosures, Junction Boxes:

   a. Provide identification plate including system type and location designation, if any, per the Drawings or Shop Drawings on cover.
   b. Indicate equipment and location(s) from which enclosed cables originate.

3. Fire Alarm:

   a. Fire alarm junction boxes shall be red unless another standard is used be owner.
   b. Initiation Devices, Notification Appliances, Fire Alarm Relays – Provide zone or address identification label, clear Marker Tape, red or black letters.
   c. Remote Smoke Detector Lamps and Test Stations – Provide label indicating the location of the connected device.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260810 – MANDATORY UL PARTICIPATION

PART 1 – GENERAL

1.01 SCOPE

A. This section addresses a mandatory site survey of electrical power panel retrofits and/or switchgear bus taps when such work is performed. The contractor shall engage the services and pay related fees of the UL field evaluation group (ULFE), or a similar firm engaging is this type of work on a regular basis.

1.02 TIMELINE

A. The contractor is advised that UL field evaluation response time is generally one to two weeks.

1.03 REGULATORY REQUIREMENTS

The specific issues addressed in panel retrofits are:

A. Panelboard interiors not marked for use in the existing back box revert to a 10 K AIC rating. If higher AIC rating is required per the project specifications and/or drawings, ULFE shall determine the actual AIC rating of the new panelboard interior back box combination, in conformance with original parameters.

B. ULFE shall specify corrective steps as required to achieve code compliance and meet the original engineering design intent. The cost of such corrective work shall be paid for by electrical contractor as part of this project.

1.04 ULFE WORK

A. ULFE shall field examine proposed bus taps for compliance with bus mechanical and power capacity ratings. They shall specify corrective actions as required.

1.05 RESPONSIBILITY

A. The contractor shall coordinate with the owner and utility company to minimize down time of electrical service for ULFE work. All electrical service outages shall be done as specified by the owner and utility company. Premium time fees if apply shall be the responsibility of the contractor.

1.06 SUBMITTALS

A. The ULFE response and related contractor response shall be part of the project final closeout submission.

1.07 UL CONTACT INFORMATION

Program Manager
Chuck Mello
877-854-3577, ext. 55578
chuck.mello@ul.com

Staff Engineer Bob Starasinich 847-224-0852
robert.m.starasinich@ul.com

Field Evaluation Service http://www.ul.com/global/eng/pages/offerings/services/globalfieldservices/fieldservices/fieldevaluationservices/

1.08 UL FIELD EVALUATIONS PROJECT DATA SHEET:

Field Evaluations Project Data Sheet

Date	

Person Contacting UL	
Title:	

Applicant Information
(Company that assumes financial obligation for the cost of the project)

Legal Company Name **Address** **City, ST, Zip**	

Taxpayer Identification Number (TIN)	
Phone No:	
Fax No:	
Cell No:	
E-Mail:	

Requested Date for FE to start	

Preliminary Field Evaluation Site (optional if requested)
(Usually taking place at the manufacturers location prior to being installed)

Company Name Address City, ST, Zip	
Contact on Site	
Phone No:	
Cell No:	
Are there any security steps necessary for the engineer to be on site (background check, NDA, ETC)	
Are there any specific safety policies we need to be aware of? (Personal Protective Equipment, Fall Protection, Required Safety classes, ETC)	

Final Installation Site
(Where the product is permanently installed & label applied)

Company Name Address City, ST, Zip	

Contact on Site	
Phone No:	
Cell No:	
Are there any security steps necessary for the engineer to be on site (background check, NDA, ETC)	
Are there any specific safety policies we need to be aware of? (Personal Protective Equipment, Fall Protection, Required Safety classes, ETC)	

Authority Having Jurisdiction
Local City / County Electrical Inspector (This is Mandatory)

AHJ Jurisdiction Address City, ST, Zip	
Name of Inspector	
Phone No:	
Fax No:	
Cell No:	
E-Mail:	

Equipment Information on Following Page

List of Equipment to be evaluated

Product Description & purpose	
Number of Units	
Manufacturer Name:	
Model Number:	
Serial Number:	
Volts & Amps Ratings	Voltage, A or FLA, Phase, Wire, (Hz), Power
Motor (how many & HP)	
Pending Litigation	Yes [ ] No [ ]
Hazardous Location:	Yes [ ] No [ ]
Equipment Condition:	New [ ] Used [ ]
Security/Signaling Equipment	Yes [ ] No [ ]
Product Under Current UL Evaluation	Yes [ ] No [ ]
Homeland Security Equipment	Yes [ ] No [ ]
E85 Gasoline Equipment	Yes [ ] No [ ]

Product Description & purpose	
Number of Units	
Manufacturer Name:	
Model Number:	
Serial Number:	
Volts & Amps Ratings	Voltage, A or FLA, Phase, Wire, (Hz), Power
Motor (how many & HP)	
Pending Litigation	Yes [ ] No [ ]
Hazardous Location:	Yes [ ] No [ ]
Equipment Condition:	New [ ] Used [ ]
Security/Signaling Equipment	Yes [ ] No [ ]
Product Under Current UL Evaluation	Yes [ ] No [ ]
Homeland Security Equipment	Yes [ ] No [ ]
E85 Gasoline Equipment	Yes [ ] No [ ]

Product Description & purpose	
Number of Units	
Manufacturer Name:	
Model Number:	
Serial Number:	
Volts & Amps Ratings	Voltage, A or FLA, Phase, Wire, (Hz), Power
Motor (how many & HP)	
Pending Litigation	Yes [ ] No [ ]
Hazardous Location:	Yes [ ] No [ ]
Equipment Condition:	New [ ] Used [ ]
Security/Signaling Equipment	Yes [ ] No [ ]
Product Under Current UL Evaluation	Yes [ ] No [ ]
Homeland Security Equipment	Yes [ ] No [ ]
E85 Gasoline Equipment	Yes [ ] No [ ]

Product Description & purpose	
Number of Units	
Manufacturer Name:	
Model Number:	
Serial Number:	
Volts & Amps Ratings	Voltage, A or FLA, Phase, Wire, (Hz), Power
Motor (how many & HP)	
Pending Litigation	Yes [ ] No [ ]
Hazardous Location:	Yes [ ] No [ ]
Equipment Condition:	New [ ] Used [ ]
Security/Signaling Equipment	Yes [ ] No [ ]
Product Under Current UL Evaluation	Yes [ ] No [ ]
Homeland Security Equipment	Yes [ ] No [ ]
E85 Gasoline Equipment	Yes [ ] No [ ]

Product Description & purpose	
Number of Units	
Manufacturer Name:	
Model Number:	
Serial Number:	
Volts & Amps Ratings	Voltage, A or FLA, Phase, Wire, (Hz), Power
Motor (how many & HP)	
Pending Litigation	Yes [ ] No [ ]
Hazardous Location:	Yes [ ] No [ ]
Equipment Condition:	New [ ] Used [ ]
Security/Signaling Equipment	Yes [ ] No [ ]
Product Under Current UL Evaluation	Yes [ ] No [ ]
Homeland Security Equipment	Yes [ ] No [ ]
E85 Gasoline Equipment	Yes [ ] No [ ]

END OF SECTION

SECTION 260924

LIGHTING CONTROLS - LUTRON VIVE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single space wireless lighting control systems and associated components:
   1. Wireless occupancy/vacancy sensors.
   2. Wireless daylight sensors.
   3. Wired load control modules with wireless communication inputs.
   4. Wired wallbox occupancy sensors with wireless communication inputs.
   5. Wireless control stations.

B. Wireless hub(s) for centralized control, monitoring, and system integration.

C. Software data and analytics dashboard, including server requirements.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2019.

C. CAL TITLE 24 P6 - California Code of Regulations, Title 24, Part 6 (California Energy Code); 2022.

D. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements; 2011, with Amendment (2015).

E. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2008.

F. ISO 9001 - Quality Management Systems — Requirements; 2015.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2020.

J. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall controls with actual installed door swings.
   3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.

5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications:
   1. Company with not less than ten years of experience manufacturing lighting control products using wireless communication between devices.
   2. Registered to ISO 9001, including in-house engineering for product design activities.
   3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.
   4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.
   1. Basis of Design System Requirements - Lutron, Unless Otherwise Indicated:
      a. Ambient Temperature:
         1) Lighting Control System Components, Except Fluorescent Electronic Dimming Ballasts: Between 32 and 104 degrees F (0 and 40 degrees C).
         2) Fluorescent Electronic Dimming Ballasts: Between 50 and 140 degrees F (10 and 60 degrees C).
      b. Relative Humidity: Less than 90 percent, non-condensing.
      c. Protect lighting controls from dust.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Standard Warranty, With Manufacturer Full-Scope Start-Up; Lutron Standard 2-Year Warranty; Lutron LSC-B2:
   1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
      a. First Two Years:
         1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
         2) First-available on-site or remote response time.
         3) Remote diagnostics for applicable systems.
      b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
   2. Lighting Management System Computer: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.
   3. Ballasts/Drivers and Ballast Modules:

a. With On-Site Full-Scope Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Lutron Electronics Company, Inc; Vive; www.lutron.com/#sle.

2.02 LIGHTING CONTROLS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

B. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.

C. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.

D. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

E. Power Failure Recovery: When power is interrupted for periods up to 10 years and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.

F. Wireless Devices:
   1. Wireless device family includes area or fixture level sensors, area or fixture level load controls for dimming or switching, and load controls that can be mounted in a wallbox, on a junction box, or at the fixture.
   2. Wireless devices including sensors, load controls, and wireless remotes or wall stations, can be set up using simple button press programming without needing any other equipment (e.g. central hub, processor, computer, or other smart device).
   3. Wireless hub adds the ability to set up the system using any smart device with a web browser (e.g. smartphone, tablet, PC, or laptop).
   4. System does not require a factory technician to set up or program the system.
   5. Capable of diagnosing system communications.
   6. Capable of having addresses automatically assigned to them.
   7. Receives signals from other wireless devices and provides feedback to user.
   8. Capable of determining which devices have been addressed.
   9. RF Range: 60 feet (18 m) line-of-sight or 30 feet (9 m) through typical construction materials between RF transmitting devices and compatible RF receiving devices.
   10. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.

G. Wireless Network:
   1. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
      a. Wireless sensors, wireless wall stations and wireless load control devices do not operate in the noisy 2.4 GHz frequency band where high potential for RF interference exists.
      b. Wireless devices operate in an uncongested frequency band providing reliable operation.
      c. Fixed network architecture ensures all associated lights and load controls respond in a simultaneous and coordinated fashion from a button press, sensor signal, or command from the wireless hub (i.e. no popcorning).
   2. Distributed Architecture: Local room devices communicate directly with each other. If the wireless hub is removed or damaged, local control, sensing, and operation continues to function without interruption.

3. Local room devices communicate directly with each other (and not through a central hub or processor) to ensure:
    a. Reliability of system performance.
    b. Fast response time to events in the space (e.g. button presses or sensor signals).
    c. Independent operation in the event of the wireless hub being removed or damaged.

H. Device Finishes:
1. Standard Colors: Comply with NEMA WD 1 where applicable.
2. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
3. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.03 WIRELESS SENSORS

A. General Requirements:
1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.

B. Wireless Occupancy/Vacancy Sensors:
1. General Requirements:
    a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
    b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
    c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
    d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
    e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
    f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
    g. Color: White.
    h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
    i. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
    j. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
    k. Ceiling-Mounted Sensors:
        1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
        2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
2. Wireless Combination Occupancy/Vacancy Sensors:
    a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature

(automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).

b. Product(s):

1) Ceiling-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH: Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.

C. Wireless Daylight Sensors:

1. Product: Lutron Radio Powr Savr Series, Model LFR2-DCRB-WH.
2. Open-loop basis for daylight sensor control scheme.
3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
5. Provide linear response from 2 to 150 footcandles.
6. Color: White.
7. Mounting:
   a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
   b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
   c. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.

2.04 LOAD CONTROL MODULES

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.

B. Junction Box-Mounted Modules:

1. Plenum rated.
2. 0-10 V Dimming Modules:
   a. Product(s):
      1) 8 A dimming module with 0-10V control, without emergency mode; Lutron PowPak Dimming Module Model RMJS-8T-DV-B.
   b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
   c. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
   d. Selectable minimum light level.
   e. Configurable high- and low-end trim.
   f. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.

2.05 WIRED WALLBOX OCCUPANCY SENSORS WITH WIRELESS COMMUNICATION INPUTS

A. 0-10 V Wall Dimmer/Switch Combination Occupancy/Vacancy Sensors with Wireless Communication Inputs; Lutron Maestro Wireless 0-10 V Dimmer Sensor/Maestro Wireless Sensor Switch Series.

1. Communicates via radio frequency with up to ten compatible wireless occupancy/vacancy sensors, ten wireless control stations, and one wireless daylight sensor.
2. Compatible with sourcing electronic 0-10 V ballasts/drivers, as per IEC 60929 Annex E.2 0-10 V protocol.
3. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be selectable as either adaptive utilizing occupant feedback (Lutron Smart Ambient Light Detection) or as fixed (high, medium, low, and minimum presets).

4. Occupancy/Vacancy Sensors:
    a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
    b. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
    c. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
    d. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area; adjustable timeout settings (1, 5, 15, and 30 minutes).
    e. Adjustable sensitivity (high, medium, low, and minimum presets).
    f. Selectable option to inhibit automatic turn-on of lights after manual-off operation while room is occupied for applications such as presentation viewing in conference rooms and classrooms; when room is vacated, returns to normal automatic-on operation after time delay period.
    g. Selectable walk-through mode to override selected timeout and automatically turn off lights if no motion is detected within 3 minutes after initial occupancy for applications where space may be briefly occupied.
5. Dimmer Features:
    a. Adjustable high/low end trims.
    b. Selectable dimming curve (linear or switched).
    c. Selectable fade on/fade off times (15, 5, 2.5, or 0.75 sec).
    d. Adjustable auto-on light level (fully adjustable from one to 100 percent).
6. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
    a. Rocker raises/lowers light level, with new level becoming the current preset level.
    b. Switch single tap raises lights to preset level or fades lights to off.
    c. Switch double tap raises light to full on level.
7. Switch Control: Switch single tap turns lights on/off.
8. Product(s):
    a. Passive Infrared 0-10 V Wall Dimmer Occupancy/Vacancy Sensor; Lutron Maestro Wireless 0-10 Dimmer Sensor/Maestro Wireless Sensor Switch Series: 0-10 V control for 0-10 V fluorescent ballasts/LED drivers (8 A load at 120-277 V, 50 mA max control current); coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; multi-location capability using Pico wireless control stations with wallbox mounting adapter.
        1) Sensor dimmer; occupancy/vacancy; Lutron Model MRF2S-8SD010.

2.06 WIRELESS CONTROL STATIONS

A. Product(s):
    1. 3-Button with Raise/Lower Control; Lutron Pico Wireless Control Model PJ2-3BRL.

B. Quantity: As indicated on the drawings.

C. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.

D. Does not require external power packs, power or communication wiring.

E. Allows for easy reprogramming without replacing unit.

F. Button Programming:
    1. Single action.
    2. Toggle action.

G. Includes LED to indicate button press or programming mode status.

H. Mounting:

1. Capable of being mounted with a table stand or directly to a wall under a faceplate.
2. Faceplates: Provide concealed mounting hardware.

I. Power: Battery-operated with minimum ten-year battery life (3-year battery life for night light models).

J. Finish: As specified for wall controls in "Device Finishes" under LIGHTING CONTROLS - GENERAL REQUIREMENTS article above.

2.07 WIRELESS HUBS

A. Product(s):
1. Wireless hub with BACnet; Lutron Vive Premium Hub.
a. Flush-mount wireless hub; Model HJS-2-FM; supports up to 700 total paired devices.

B. Integrated multicolor LED provides feedback on what mode the hub is in for simple identification and diagnosis.

C. Integrated processor and web server allows hub to set up and operate the system without any external connections to outside processors, servers, or the internet.

D. Utilizes Ethernet connection for:
1. Networking up to 64 hubs together to create a larger system.
2. Integration with Building Management System (BMS) via native BACnet; does not require interface (Lutron Vive Premium wireless hub with BACnet only).
3. Remote connectivity capabilities, including maintaining system date/time and receiving periodic firmware updates (requires internet connection).

E. A single hub or network of hubs can operate on either a dedicated lighting control only network or can be integrated with an existing building network as a VLAN.

F. Communicates directly to compatible Lutron Vive RF devices through use of Lutron Clear Connect radio frequency communications link; does not require communication wiring; RF range of 71 feet (23 m) through walls to cover an area of 15836 square feet (1471 sq m) (device and hub must be on the same floor).

G. Communicates directly to mobile device (smartphone or tablet) or computer using built-in Wi-Fi. 2.4 GHz 802.11b/g; wireless range of 71 feet (23 m) through walls (device and hub must be on the same floor).
1. Does not require Wi-Fi router for connecting to the hub.

H. Allows for system setup, control, and monitoring from mobile device or computer using Vive web-based software:
1. Supports paired devices up to maximum number indicated including compatible wireless sensors, wireless control stations, and wireless load devices.
2. Allows for timeclock scheduling of events, both time of day and astronomic (sunrise and sunset).
a. Timeclock is integrated into the unit and does not require a constant internet connection.
b. Retains time and programming information after a power loss.
c. 365-day schedulable timeclock allows for:
1) Scheduling of events years in advance.
2) Setting of recurring events with exceptions on holidays.
d. Timeclock events can be scheduled to:
1) Send lights to a desired level and select the fade rate desired to reach that level.
2) Adjust level lights go to when occupied.
3) Adjust level lights go to when unoccupied.
4) Enable/disable occupancy.
5) Adjust timeout of sensors (requires Lutron Model FC-SENSOR wired fixture sensor or Lutron Model DFCSJ-OEM-OCC wireless fixture control dongle with integral sensing capabilities).
3. Daylighting:

a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
b. Daylight set point can be adjusted with the software to increase or decrease the electric light level in the room based on the same amount of natural light.

4. Allows for control, monitoring, and adjustment from anywhere in the world (Lutron Vive wireless hub internet connection required).
5. Uses RF signal strength detection to find nearby devices for quick association and programming without having to climb ladders.
   a. Association and setup does not require a factory technician to perform.
6. System using Lutron Vive wireless hub(s) can operate with or without connection to the internet.
7. Supports energy reporting.
   a. Reports measured energy data for PowPak fixture control modules at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
   b. Reports calculated energy data for PowPak junction box mounted modules at accuracy of 10 percent.
8. Supports automatic demand response for load shedding via:
   a. Local contact closure without need for separate interface.
   b. OpenADRae 2.0b compliant utility command.
   c. BACnet (Lutron Vive Premium wireless hub with BACnet only).
9. Support automatic generation of alerts in Lutron Vive web-based application for designated events/triggers, including:
   a. Low-battery condition in battery-operated sensors and controls; alert cleared when battery is replaced.
   b. Missing device (e.g., control or sensor); alert cleared when device is detected.
10. Wireless hub can be firmware upgraded to provide new software features and system updates.
    a. Firmware update can be done either locally using a wired Ethernet connection or Wi-Fi connection, or remotely if the wireless hub is connected to the internet.

I. Lutron Vive Web-Based Application:
1. Accessibility and Platform Support:
   a. Web-based; runs on most HTML5 compatible browsers (including Safari and Chrome).
   b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone.
   c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
   d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
   e. Multi-level Password Protected Access: Individual password protection on both the integrated Wi-Fi network and web-based software.
   f. WPA2 security for Wi-Fi communication with wireless hub.
2. System Navigation and Status Reporting:
   a. Area Tree View: Easy navigation by area name to view status and make programming adjustments through the software.
   b. Area and device names can be changed in real time.
3. Setup app available for iOS and Android that allows for:
   a. Job registration to extend product warranty.
   b. Management of setup for multiple projects in different locations.
   c. Creation of handoff documents that are sent directly to a facility manager via email once setup is complete.
   d. Backup of Vive wireless hub database to Lutron cloud for hub replacement.
   e. Access to native help and instructions to assist user with Vive system setup.

J. BACnet Integration (Lutron Vive Premium wireless hub with BACnet only):

1. Provide ability to communicate by means of native BACnet IP communication (does not require interface) to lighting control system from a user-supplied 10BASE-T or 100BASE-T Ethernet network.
2. Requires only one network connection per hub.
3. BACnet Integrator Capabilities:
    a. The BACnet integrator can command:
        1) Area light output.
        2) Area load shed level.
        3) Area load shed enable/disable.
        4) Enable/Disable:
            (a) Area occupancy sensors.
            (b) Area daylighting.
        5) Daylighting level.
        6) Area occupied and unoccupied level
        7) Occupancy sensor timeouts (for fixture sensors).
    b. The BACnet integrator can monitor:
        1) Area on/off status.
        2) Area occupancy status.
        3) Area load shed status.
        4) Area instantaneous energy usage and maximum potential power usage.
        5) Enable/Disable:
            (a) Area occupancy sensors.
            (b) Daylighting.
            (c) Timeclocks.
        6) Daylighting level.
        7) Light levels from photo sensors.
        8) Area occupied and unoccupied level.
        9) Occupancy sensor timeouts.

K. API Integration:
1. Support communication, without requiring interface, between lighting control system and third-party system via RESTful API.
2. Requires one network connection per wireless hub.
3. API Integration Capabilities:
    a. Control all zones or subset of zones.
        1) Set zones in designated area to specific level.
        2) Raise/lower dimmable lights in designated area.
    b. Control individual zones.
    c. Subscribe to and Monitor:
        1) Area status changes (e.g, occupancy, light level, and instantaneous power).
        2) Individual zone changes in light level.
        3) Alerts (e.g., missing device and low battery).

L. Scenes:
1. Support programmable scenes to control individual devices, areas, or groups of areas on demand.
2. Scenes may be activated via:
    a. Contact closure input.
    b. API integration.
    c. Manual activation in app.

M. Emergency Mode:
1. Support emergency mode to, when triggered, send lights to defined levels and lock out controls for PowPak load control modules equipped with emergency mode.
2. Emergency mode may be activated via:
    a. Contact closure input.

b. API integration.
c. Manual activation in app.

N. Contact Closure Interface: Provide two contact closure inputs; accepts both momentary and maintained contact closures that can be used for automatic demand response.

O. Rated for use in air-handling spaces as defined in UL 2043.

P. Meets CAL TITLE 24 P6 requirements.

Q. Provide Ethernet switch(es) as required for inter-hub network wiring per manufacturer's instructions; do not exceed manufacturer's required maximum wiring segment lengths.

2.08 SOFTWARE DATA AND ANALYTICS DASHBOARD

A. Control and Monitor Software:
1. Product: Lutron Vive Vue.
2. General Requirements:
a. Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).
b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.
c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
e. All functionality listed below must be available via a single application.
3. System Navigation and Status Reporting:
a. Performed using graphical floor plan view or a generic system layout.
b. Graphical Floor Plan View: Utilizes customized CAD based drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.
4. Control of Lights:
a. Control and monitor zone/area lights.
1) Area lights can be monitored for on/off status from a graphical floor plan or generic system layout.
2) All lights in an area can be turned on/off (dimmable lights can also be dimmed up/down from current level).
5. Occupancy:
a. Area occupancy can be monitored.
1) Can be monitored graphically if a graphical floor plan has been created.
2) Can be monitored historically in space utilization reports.
b. Scheduled events can be created to change occupancy parameters as described under "Scheduling" below.
6. Load Shedding: View current load shed status (active/inactive) for each Vive wireless hub and enable/disable load shed for the entire building/system.
7. Scheduling: Schedule time of day and astronomic time clock events to automate functions.
a. Scheduled events can control the following:
1) Area light levels for all dimmable lights in an area.
2) On/off status of all switched lights and contact-closure outputs in an area.
3) On/off status of all switched receptacles in an area.
4) Occupancy parameters as follows:
(a) Enable/disable sensors.
(b) Change occupancy mode (auto-on/auto-off versus manual-on/auto-off).
(c) Adjust occupied and/or unoccupied level.
(d) For compatible individual fixture sensors, sensor timeout can be adjusted.
b. Easily monitor and adjust scheduled events using a weekly calendar view.

8. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:
    a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas.
    b. Power Reports: Show power usage trend over a period of time for one or more areas.
    c. Space Utilization/Occupancy Reports: Show historical occupancy over a period of time for one or more areas using a graphical floor plan, generic system layout, and graphs and charts.
9. Administration:
    a. Users: Allows new user accounts to be created and existing user accounts to be edited.
        1) Supports Active Directory (LDAP) tying user accounts to network accounts.
    b. Area and feature access can be restricted based on login credentials.
    c. Supports up to 20 concurrent users and 10,000 user accounts.
10. Devices/Settings Adjustment:
    a. Users with appropriate permissions can navigate to the wireless hub setup screens in order to view and/or adjust specific settings for areas or devices (including load shed settings, daylighting settings, device associations and programming, occupancy settings, high-end/low-end trim settings, etc).

B. Computers:

2.09 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory Testing; Lutron Standard Factory Testing:
1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
2. Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, except for mounting heights specified in those standards.

B. Install products in accordance with manufacturer's instructions.

C. Sensor Locations:
1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.

D. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

E. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

F. Identify system components in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Manufacturer's Full-Scope Start-Up Service is required.

C. Manufacturer's Full-Scope Start-Up Service: Provide manufacturer's On-Site Full-Scope Start-Up Service.

1. On-Site Full-Scope Start-Up Service; Lutron LSC-OS-SU-VIVE: Manufacturer's authorized Service Representative to conduct site visit upon completion of lighting control system installation to perform system start-up and verify proper operation:
    a. Verify connection of power wiring and load circuits.
    b. Verify connection and location of controls.
    c. Energize wireless hubs.
    d. Associate occupancy/vacancy sensors, daylight sensors, wireless remotes, and wall stations to load control devices.
    e. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS".
    f. Program timeclock schedules per approved sequence of operations.
    g. Configure load shed parameters per approved sequence of operations.
    h. Verify system operation control by control.
    i. Obtain sign-off on system functions.
    j. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".

D. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 CLOSEOUT ACTIVITIES

A. Training:
1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site system start-up services.

END OF SECTION

DIVISION 26– ELECTRICAL

SECTION 260943 – NETWORK LIGHTING CONTROLS

PART 1– GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall Box Occupancy Sensors
2. Ceiling Occupancy Sensors
3. Daylight Sensors
4. Low Voltage Wall Stations
5. Load Control Relays

1.3 DEFINITIONS

A. BAS: Building-Automation System

B. FC: Footcandles

C. LED: Light-Emitting Diode.

D. PIR: Passive Infrared.

E. VAC: Volts, Alternating Current

F. VDC: Volts, Direct Current

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 – Administrative Requirements.

B. Product Data:

1. Bill of Materials: Complete list of parts required to provide a complete and functioning Lighting Control System.

2. Manufacturer’s Data Sheets: Data Sheets are to provide information on item function, features, and dimensions.

3. Shop and Wiring Drawings

    a. Submit typical wiring diagrams for all components including, but not limited to, wall box occupancy sensors, ceiling mounted occupancy sensors, daylight sensors, load control relays, and low-voltage wall stations.

b. Show installation locations and details for occupancy sensors, daylight sensors, load control relays, and low-voltage wall stations.

4. Warranty: Provide copy of applicable device warranty.

C. Coordination:

1. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including luminaires, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

1.5 WARRANTIES

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in material or workmanship within specified warranty period.

1. Failures include any faulty operation of lighting control device(s).

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer Qualifications: Manufacturer of Lighting Control System listed in this Section must be comparable to Basis of Design and equal system must meet operational requirements.

1. SENSORWORX (Basis of Design)

2. XXXXX

3. XXXXX

B. Quality Assurance: All control devices shall be visually inspected by an individual to be free of defects and tested for proper device functionality.

2.2 WALL BOX OCCUPANCY SENSORS

1. General: Provide wall box occupancy sensor for stand-alone control of lighting load in areas shown on Drawings.

B. System Components: Occupancy sensor lighting control shall include, but not be limited to, all required sensors, relays, power supplies, and low-voltage or line-voltage wiring.

C. Sensor Requirements:

1. Sensor unit to be self-contained in impact resistant plastic, suitable for mounting in a standard switch box.

2. Sensor shall be less than one (1) inch deep into the switch box in order to provide maximum space for wire connections.

3. Sensor shall have interchangeable face colors that can be field changed without removing the unit from wall box or rewiring.

4. Sensor unit shall be available with the following powered methods:

    a. Line voltage, 120VAC or 277VAC, supplied by utility through a local circuit.
    b. Low voltage, 12-24VDC, supplied by power supply or power pack.

5. Sensor unit (Line voltage version) is rated for 800 Watts @ 120VAC and 1200 Watts @ 277VAC. Low voltage version is to be wired to a self-contained powerpack.

6. Sensor unit accommodates neutral (3-wire) and no neutral (2-wire) installation. Unit meets NEC 404.2© & 404.22 guideless regarding powering over ground & current leakage.

7. Sensor unit shall have interchangeable line and load wires.

8. Sensor unit shall contain a passive infrared detector and an optional on-board microphone in dual technology models. Sensor unit requires a passive infrared detection event to activate lights and will maintain occupied state dependant on continued passive infrared detection or, when dual technology is present, acoustic detection of occupants by the microphone.

9. Sensor unit shall have an option of an integrated photocell for ambient light sensing. The functional mode of this photo sensor shall be initial inhibit only; i.e. if enough ambient light is sensed for a duration of five (5) minutes, unit will prevent the lights from automatically turning on. Sensor unit shall have an auto-setpoint option or a manual setpoint from 2.5fc to 99fc.

10. Sensor unit shall have several programable modes of operation:

    a. Occupancy Mode

    b. Vacancy Mode

    c. Automatic On with Exit Time

    d. Override Off Mode

    e. Disable Switch Mode

    f. Presentation Mode

11. Sensor unit settings shall be adjustable without removing wall plate cover or unit from wall box.

12. Sensor unit shall have multiple colors of LED indicator light for the following:

    a. Detection of occupancy, either passive infrared or acoustic detection.
    b. Response to programming push button.
    c. Indication of function current setting when queried.
    d. Error code sequence.

13. Sensor unit shall be available with the ability to control additional line-voltage loads via companion “sidecar” switches located in a common multi-gang wall box. All sidecars shall receive detection signal from the primary sensor unit. Sidecar units can operate with the same or different operational modes, time delays, and detection types as the primary sensor unit.

14. Sensor unit shall have a multi-sensor option available with the low-voltage models. This allows multiple sensors (wall-box or ceiling mounted) and/or switches to control a single load together with combined coverage.

15. Sensor unit shall have an operating temperature from 32°F to 122°F (0°C to 50°C) standard, and down to -40°F/C with an optional conformal coating.

16. Sensor shall be UL Listed, RoHS Compliant, and BAA Compliant.

17. Full electronic and mechanical assembly of sensors shall be in the USA.

2.3 CEILING OCCUPANCY SENSORS

A. General: Provide a complete and operable occupancy sensor lighting control system in areas shown on Drawings.

B. System Components: Occupancy sensor lighting control shall include, but not be limited to, all required sensors, relays, power supplies, and low-voltage or line-voltage wiring.

C. Sensor Requirements:

1. Sensors shall contain a passive infrared detector and an optional on-board microphone in dual technology models. Sensor unit requires a passive infrared detection event to activate lights and will maintain occupied state dependant on continued passive infrared detection or, when dual technology is present, acoustic detection of occupants by the microphone.
2. Sensors shall be available with the following powered methods:
    a. Low voltage, 12-24VDC, supplied by power supply or power pack.
    b. Line voltage, 120VAC or 277VAC, supplied by utility through a local circuit.
3. Sensor shall have an optional integral photocell with three different modes of operation available:
    a. Daylight Harvesting (0-10V Dimming to maintain the target light level).
    b. ON/OFF Photocell Control (Lights switched OFF if ambient level surpasses the threshold and back ON if level drops).
    c. Inhibit Only Photocell Control (Lighting is held OFF if sufficient ambient light level is present upon initial occupancy).
4. Sensor housing shall be impact resistant plastic.
5. Sensors shall have adjustable time delay increment settings from 30 seconds to 30 minutes (default 10 minutes), that is easily accessible to the user.
6. Sensors have been designed to fail to the ON condition for predictable internal failure conditions.
7. Sensor shall have multiple colors of LED indicator light for the following:
    a. Detection of occupancy, either passive infrared or acoustic detection.
    b. Response to programming push button.
    c. Indication of function current setting when queried.
    d. Error code sequence.

8. Sensors shall have the ability to be wired in parallel to provide detection coverage of large areas beyond the range of a single unit. All joined sensors must time out (i.e. register unoccupied) before the lights will turn OFF.

9. Sensor shall be available with an isolated low voltage relay for providing interfaces. Relay shall communicate occupancy status to BAS, HVAC system, or any other system requiring a contact closure style status signal. Relay logic shall be programmable.

10. Sensors shall be available with the following lens options:

    a. Ceiling-Mounted (lenses can be swapped in field, if necessary, without need for any tools):

        .1 360° field of view for small motion (8 to 12 feet above finished floor).

        .2 360° field of view for large motion (8 to 15 feet above finished floor).

        .3 360° field of view for high bay application (15 to 40 feet above finished floor).

    b. Wall-Mounted

        .1 120° field of view for corner mount application.

        .2 45° field of view for hallway application.

11. Sensors shall have an operating temperature from 32°F to 122°F (0°C to 50°C) standard, and down to -40°F/C with an optional conformal coating.

12. Sensor shall be UL Listed, RoHS Compliant, and BAA Compliant.

13. Full electronic and mechanical assembly of sensors shall be in the USA.

2.4 DAYLIGHT SENSORS

A. General: Provide a complete and operable daylight sensor system in areas shown on Drawings.

B. System Components: Daylight sensor lighting control shall include, but not be limited to, all required sensors, relays, power supplies, and low-voltage or line-voltage wiring.

C. Sensor Requirements:

1. Sensors shall be self-contained, photo-electric detectors which shall provide detection of ambient light level in a given area.

2. Sensors shall be available with the following powered methods:

    a. Low voltage, 12-24VDC, supplied by power supply or power pack.
    b. Line voltage, 120VAC or 277VAC, supplied by utility through a local circuit.

3. Sensor housing shall be impact resistant plastic.

4. Setpoint: The minimum overall light level that shall be maintained in a space by the sensor is referred to as the Setpoint.

a. Sensor shall have manually adjustable setpoint from 2.5fc to 100fc.
b. Sensor shall have an auto-setpoint method which shall automatically determine setpoint in a given area based on the controlled and uncontrolled light sources.

5. Sensor shall have the following operational modes:

   a. Daylight Harvesting to Low Trim
   b. Daylight Harvesting to Off (requires power pack)
   c. Photocell Override (On/Off)
   d. Initial Inhibit Only (Hold Off)

6. Sensor with Daylight Harvesting option restricts the manual dimming range by a wall dimmer station to a maximum level that equals the setpoint down to the low-trim and/or off position. Sensor will ignore any attempt to raise the lighting above the setpoint with any wall dimmer station.

7. Sensor shall have multiple colors of LED indicator light for the following:

   a. Notification of upcoming transition to On or Off
   b. Indication of ambient level of lighting being sufficient
   c. Response to programming push button
   d. Indication of function current setting when queried

8. Sensor shall have an operating temperature from 32°F to 122°F (0°C to 50°C) standard, and down to -40°F/C with an optional conformal coating.

9. Sensor shall be UL Listed, RoHS Compliant, and BAA Compliant.

10. Full electronic and mechanical assembly of sensors shall be in the USA.

2.5 LOW VOLTAGE WALL STATIONS

A. General: Provide low voltage wall stations as required in areas shown on Drawings. These devices are to function seamlessly with other control devices.

B. System Components: Low Voltage Wall Station shall include, but not be limited to, all required sensors, relays, power supplies, and low-voltage wiring.

C. Wall Station Requirements:

1. Station shall be capable of switching and/or dimming the lighting load with a momentary pulse length of 250msec.

2. Station shall have multiple colors of LED indicator light for the following:

   a. Location of switch when lighting load is Off
   b. Relay status
   c. Response to programming push button
   d. Indication of function current setting when queried
   e. Current dimming level with five (5) stacked LEDs displayed to the user (dimming station only)

3. Station shall be capable of Multiway Switching with all connected stations indicate the same state. Manual dimming control shall be available at one (1) location.

4. Station shall have an operating temperature from 32°F to 122°F (0°C to 50°C) standard, and down to -40°F/C with an optional conformal coating.

5. Station shall be UL Listed, RoHS Compliant, and BAA Compliant.

6. Full electronic and mechanical assembly of sensors shall be in the USA.

7. Dimming Station:

   a. Station shall have High-End and Low-End Trim settings:

      .1 High End Trim enables energy saving task tuning by setting a maximum level (100%-50%) to which users are allowed to raise lights.
      .2 Low-End Trim enables minimum user level of dimmer to be customized.

   b. Station shall have Turn On/Turn Off Dimming Operation (when used with a load controller and an occupancy sensor):

      .1 Turns On lighting to last user level or can be programmed to a pre-set level (100%, 50%, or custom).

      .2 Lighting can turn Off lighting by switching Off power (by opening relay) or dimming below electronic Off Level.

      .3 Lighting can also be held at low-end trim level during unoccupied/off state.

   c. Station shall have adjustable Fade On and Fade Off Times;

      .1 Adjustable time interval for level to ramp up to Turn On Level is 0.75 sec, 1.5 sec, 3 sec, 5 sec, or 15 sec.
      .2 Adjustable time interval for level to ramp down to Off is 0.75 sec, 1.5 sec, 3 sec, 5 sec, or 15 sec.

   d. Station shall have selectable Dimming Curves, which define how the dimmer unit adjusts its voltage output in response to button commands:

      .1 Linear (default)
      .2 Logarithmic
      .3 Square Log

2.6 LOAD CONTROL RELAYS

A. General: Provide a complete and operable load control relay system to be used in conjunction with occupancy sensors, daylight sensors, and wall stations in areas shown on Drawings.

B. System Components: Load Control Relays shall include, but not be limited to, all required sensors, wall stations, power supplies, and low-voltage or line-voltage wiring.

C. System Requirements:

1. Load Control Relay shall have an operating voltage of 120VAC or 277VAC.

2. Load Control Relay shall have a Class 2 Output Rating of at least 18VDC, 150mA with 80mA dedicated to powering connected devices. Voltage will be higher when a reduced low voltage load is connected.

3. Load Control Relay shall be capable of switching the following loads:

   a. 20A @ 120VAC – General Purpose Plug Load
   b. 20A @120/277 VAC – General Purpose, Tungsten, Magnetic Ballast

c. 16A @ 120/277 VAC – Electronic Ballast, LED Driver

4. Load Control Relay shall have the following options to be ordered:

   a. PowerPack with Single Relay with 150mA Supply
   b. PowerPack as Secondary Relay
   c. Power Supply (No Relay) with 150mA Supply

5. Load Control Relay housing shall be impact-resistant plastic.

6. Load Control Relay shall have snaps integrated into the chase nipple to enable quick mounting to a junction box via a standard knockout.

7. Load Control Relay shall have an optional snap-on low voltage wiring chamber for concealing low voltage wire connections.

8. Load Control Relay shall have multiple colors of LED indicator light for the following:

   a. Indication of normal or other-than-normal operation
   b. Response to programming push button
   c. Indication of function current setting when queried
   d. Indication of successful or unsuccessful push button programming

9. Load Control Relay shall have optional 0-10 Volt Stepped Dimming for Partial Off or Partial On Operation.

10. Load Control Relay shall have optional Auxiliary Switch Input wires for Manual On, Hold On, or Hold Off Operation.

11. Load Control Relay shall have a relay status output signal to keep all connected wall station indicator LEDs operating in unison.

12. Load Control Relay shall have the following operational modes:

    a. Auto On / Auto Off (Occupancy Mode)
    b. Manual On / Auto Off (Vacancy Mode) – requires Low Voltage Wall Station(s)
    c. Override On for Logic High or Logic Low
    d. Override Off for Logic High or Logic Low

13. Load Control Relay shall have an operating temperature from 32°F to 122°F (0°C to 50°C) standard, and down to -40°F/C with an optional conformal coating.

14. Load Control Relay shall be UL Listed, Plenum Rated (UL2043), RoHS Compliant, and BAA Compliant.

15. Full electronic and mechanical assembly of load control relay shall be in the USA.

PART 3– EXECUTION

3.1 INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other constructions that is supported by and/or penetrates the ceiling, including luminaires, smoke detectors, HVAC equipment, and fire-suppression systems.

B. Install and aim sensors to achieve not less than 90 percent coverage of indicated areas. Do not exceed coverage dimensions as specified by the manufacturer. Allow six (6) feet of cable slack for sensor location adjustment.

3.2 IDENTIFICATION

A. Identification: Refer to Section 26 05 53, “Identification of Electrical Systems”, for specific identification requirements, including, but not limited to, identification of circuits and luminaires, labelling, nameplates, and applicable painting.

3.3 WIRING

A. Wiring Method: Comply with Section 26 05 19 “Low-Voltage Electrical Power Conductors and Cables”.

B. Size conductors according to lighting control device manufacturer’s written instructions, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field Testing: Perform the following field tests and inspections and prepare test reports:

1. After installing all sensors, load controllers, and wall stations, and after electrical circuity has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device and confirm the time delay duration.

B. Demonstration: Upon completion of testing and adjustment, the Contractor shall demonstrate operation of the system to representatives of the Owner and Engineer.

C. Training: The Contractors shall instruct the Owner's personnel in proper maintenance, adjustment, and operation of the occupancy sensor lighting controls.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262213 – DRY-TYPE DISTRIBUTION TRANSFORMERS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

1.03 REFERENCES

A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.

B. Transformers shall meet the requirements of the most current version of Federal Law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

1.04 SUBMITTALS – FOR REVIEW / APPROVAL

A. The following information shall be submitted to the Engineer:

1. Outline dimensions and weights

2. Transformer ratings including:

a. kVA
b. Primary and secondary voltage
c. Taps
d. Basic impulse level (BIL) for equipment over 600 volts
e. Design impedance
f. Insulation class and temperature rise
g. Sound level.
h. Product data sheets

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes.

1. Final as-built drawings and information for items listed in Paragraph 1.04 and shall incorporate all changes made during the manufacturing process.
2. Connection diagrams.

3. Installation information.

4. Seismic certification and equipment anchorage details as specified.

1.06 QUALIFICATIONS

A. The manufacturer of the dry-type distribution transformers shall be the same as the manufacturer of the other major electrical distribution equipment on the project.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer shall be a participant in the UL Data Acceptance Program (DAP) under the Client Test Data Program (CTDP) certification to ensure UL test methodologies and record traceability complies with the requirements of ISO 17025.

D. Transformer must bear the UL Energy Efficiency Verification Mark to confirm that the unit meets the requirements of 10 CFR Part 431.

E. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

F. The transformers shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) for Zone 0 application for Long Island locations and Zone 2A application for other areas in eastern New York State. Guidelines for the installation consistent with these requirements shall be provided with the transformer and be based upon testing of representative equipment.

1.07 REGULATORY REQUIREMENTS

A. All transformers shall be UL listed and bear the UL label.

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUAL

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Eaton

B. General Electric

C. Square D

D. Approved Equal

2.02 RATINGS

A. The kVA and voltage ratings shall be as indicated on the drawings.

B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

C. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

D. Transformers efficiency shall be measured according to federal law 10 CFR Part 431.

E. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

	Self Cooled Ventilated		Self Cooled Sealed
Equivalent Winding kVA Range	K-Factor=1 K-Factor=4 K-Factor=9	K-Factor=13 K-Factor=20	
3.00 and below	40	40	45
3.01 to 9.00	40	40	45
9.01 to 15.00	45	45	50
15.01 to 30.00	45	45	50
30.01 to 50.00	45	48	50
50.01 to 75.00	50	53	55
75.01 to 112.50	50	53	55
112.51 to 150.00	50	53	55
150.01 to 225.00	55	58	57
225.01 to 300.00	55	58	57
300.01 to 500.00	60	63	59
500.01 to 700.00	62	65	61
700.01 to 1000.00	64	67	63
Greater than 1000	Consult Factory	Consult Factory	Consult Factory

F. Where K-factor transformers are indicated on the drawings, the transformers shall be specifically designed to supply circuits with a harmonic profile equal to or less than a K-factor of 4 without exceeding 150 degrees C temperature rise.

2.03 CONSTRUCTION – GENERAL PURPOSE TRANSFORMERS

A. Insulation Systems

1. Transformer insulation system shall be as follows:

   a. Less than 15 kVA: 180 degrees C insulation system with 115 degree C rise, encapsulated design; 15 kVA and above: minimum of 220 degree C insulation system with 150 degree C rise, ventilated design.

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C.

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction.

2. On three-phase units rated 9 kVA and below and single-phase units rated 10 kVA and below the core and coil assembly shall be completely encapsulated in a proportioned mixture of epoxy or resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level.

3. On three-phase units rated 15 kVA and above and single-phase units rated 15 kVA and above the coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The assembly shall be installed on vibration-absorbing pads.

4. Terminals shall be welded to the leads of the coils for better conductivity, less maintenance, and lower risk of hot spots. Terminals shall not be spot welded or bolted to the coil leads.

C. Taps

1. Three-phase transformers rated 15 through 225 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 225 kVA shall be provided with manufacturer's standard taps for that rating.

2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500 kVA, shall be provided with the manufacturer's standard tap configuration.

D. Electrostatic Shielding

1. Where shown on the drawings, provide shielded isolation transformers with an electrostatic shield consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.

    a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.
    b. Electrostatic shielding shall provide the following minimum attenuation when tested per MIL-Std-220A, Method of Insertion Loss Measurement, with matched impedance no load technique:

        1) Common mode noise attenuation: Minus 80 dBA minimum at 0.1 kHz to 1.5 kHz; minus 55 dBA minimum at 1.51 kHz to 100 kHz. Normal mode (Transverse mode) noise attenuation: Minus 35dBA minimum at 1.5 kHz to 10 kHz.

E. Motor Drive Isolation

1. Where shown on the drawings, provide motor drive isolation transformers.

2. Motor drive isolation transformers shall be designed for use with three-phase ac adjustable frequency drives 600 volts and below to provide isolation between the incoming line and drive circuitry. These drives minimize the line disturbances caused by SCR firing within the drive unit. Thermoguards shall be included in all motor drive isolation transformers to provide

additional protection for the transformer from increased heating due to the non-sinusoidal characteristics of drive currents. The transformer shall provide reduced short-circuit currents and voltage line transients. The transformer shall be specifically sized to the drive kVA requirements dictated by the horsepower of the motor and, as such, will be mechanically braced to withstand the stress of current reversals and short-circuit currents associated with the specific drive kVA rating.

2.04 CONSTRUCTION – K-FACTOR TRANSFORMERS

A. Insulation Systems

1. Transformers shall be insulated with a UL recognized minimum 200 degrees C insulation system.

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient and a 24-hour average ambient of 30 degrees C.

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction. The core shall provide reduced induced currents in the steel caused by the high ratios of peak-to-rms currents and voltages found in harmonic loads.

2. The neutral bus shall be configured to accommodate 200% of the rated current.

3. The coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The assembly shall be installed on vibration-absorbing pads.

C. Taps

1. Three-phase K-factor rated transformers through 225 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 225 kVA shall be provided with the manufacturer’s standard taps for that rating.

2. Single-phase K-factor rated transformers shall be provided with manufacturer’s standard tap configuration.

D. Electrostatic Shielding

1. Provide K-rated transformers with electrostatic shielding consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.

   a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

b. Electrostatic shielding shall provide the following minimum attenuation when tested per MIL-Std-220A, Method of Insertion Loss Measurement, with matched impedance no load technique:
c. Common mode noise attenuation: Minus 80 dBA minimum at 0.1 kHz to 1.5 kHz; minus 55 dBA minimum at 1.51 kHz to 100 kHz. Normal mode (Transverse mode) noise attenuation: Minus 35dBA minimum at 1.5 kHz to 10 kHz.

2.05 CONSTRUCTION – HARMONIC MITIGATING TRANSFORMERS

A. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging electrical steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed.

2. The coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The internal core and coil assembly shall be installed on vibration-absorbing pads.

3. Transformers shall be of two-winding construction. The primary winding shall be a delta, three-wire connection and the secondary winding shall be wye-zigzag with a wye field connection.

4. Primary and secondary windings shall be wound of electrical grade aluminum with continuous wound construction. All terminals and bussing shall be aluminum.

5. Transformers shall be insulated with a UL recognized minimum 200 degrees C insulation system. Winding temperature rise shall not exceed 150 degrees C.

6. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C.

7. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

8. Neutral conductor shall be aluminum and rated to carry 200% of normal phase current.

9. Windings shall have a BIL of 10 KV.

B. Taps

1. Three-phase harmonic mitigating transformers rated 15 through 225 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 225 kVA shall be provided with manufacturer's standard taps for that rating.

C. Electrostatic Shielding

1. Harmonic mitigating transformers shall be provided with an independent, single, full-width electrostatic shield consisting of a single turn of □[aluminum][copper] placed between each primary and secondary winding and grounded. [Option: double-shielding available]

   a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

b. Electrostatic shielding shall provide the following minimum attenuation when tested per MIL-Std-220A, Method of Insertion Loss Measurement, with matched impedance no load technique:
c. Common mode noise attenuation: Minus 80 dBA minimum at 0.1 kHz to 1.5 kHz; minus 55 dBA minimum at 1.51 kHz to 100 kHz. Normal mode (Transverse mode) noise attenuation: Minus 35dBA minimum at 1.5 kHz to 10 kHz.

2.06 HARMONIC TREATMENT

A. Harmonic Mitigating Transformers (HMTs) shall have a low Positive/Negative sequence impedance (between 4.6% and 7.2%) and low Zero-Sequence impedance/reactance (less than 0.55% and 0.47% respectively).

B. Triplen harmonics shall be treated in the secondary windings through flux cancellation and not coupled into the primary delta winding.

C. 5^{th} and 7^{th} harmonic currents shall be treated through the pairing of phase-shifted transformers such that these harmonic currents subtract at the common bus feeding the transformers with harmonics produced by other similar sources.

D. Each of the transformers used to treat 5^{th} and 7^{th} harmonic currents shall also treat triplen harmonics in the secondary windings of each transformer.

E. Fundamental current imbalance shall be reduced on the primary when compared to the secondary load measurements.

F. Harmonic treatment shall be through electromagnetic means; filters, capacitors, power electronic circuitry or other such devices shall not be used to treat harmonics.

G. Thermal Sensors

1. When required, provide transformers with a thermal sensor set at 190 degrees C. Provide a second thermal sensor set at 175 degrees C when required. Thermal sensor(s) shall be factory-installed in the center coil of the transformer and factory-wired to a terminal strip. Thermal sensors shall consist of a set of dry contacts.

2.07 WIRING / TERMINATIONS

A. Recommended external cable shall be rated 90 degrees C (sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.

2.08 ENCLOSURE

A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C per UL requirement. The core of the transformer shall be grounded to the enclosure.

B. On three-phase units rated 9 kVA and below and single-phase units rated 10 kVA and below the enclosure construction shall be encapsulated, totally enclosed, non-ventilated, NEMA 3R, with lifting provisions.

C. On three-phase units rated 15 kVA and above and single-phase units rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting provisions. All ventilation

openings shall be protected against falling dirt. On outdoor units, provide weathershields over ventilated openings.

D. Ventilated type transformers that meet 10 CFR Part 431 efficiency requirements, with a core size of 150 kVA or less, shall be suitable for installation with 2-inch clearance from a wall or other obstruction behind the transformer enclosure.

2.09 FINISH

A. Steel enclosures shall be finished with ANSI 61 color, weather-resistant enamel. Stainless steel enclosures shall not be painted.

2.10 OPTIONAL ACCESSORIES

A. On ventilated outdoor units provide suitable weathershields over ventilation openings.

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Ratio tests at the rated voltage connection and at all tap connections.
2. Polarity and phase relation tests on the rated voltage connection.
3. Applied potential tests.
4. Induced potential test.
5. No-load and excitation current at rated voltage on the rated voltage connection.

3.02 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.03 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage.

3.04 FIELD TESTING

A. Measure primary and secondary voltages for proper tap settings.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262416 – PANELBOARDS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260500 – Common Work Results for Electrical
C. Section 260553 – Identification for Electrical Systems

1.03 REFERENCES

A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:

1. UL 67 – Panelboards
2. UL 50 – Cabinets and boxes
3. NEMA PB1
4. Fed. Spec. W-P-115C
5. UL98 – Fusible Switches

1.04 SUBMITTALS – FOR REVIEW / APPROVAL

A. The following information shall be submitted to the Engineer for each panelboard:

1. Breaker layout drawing with dimensions indicated and nameplate designation.
2. Component list
3. Conduit entry/exit locations
4. Assembly ratings including:

    a. Short-circuit rating
    b. Voltage
    c. Continuous current

5. Cable terminal sizes
6. Product data sheets

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

B. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process.

C. Installation information

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 REGULATORY REQUIREMENTS

A. Panelboard overcurrent protective devices shall be selectively coordinated with all supply side overcurrent protective devices as required for this project by the National Electrical Code/NFPA 70 Articles 645.27, 700.27, 701.27 and 708.54.

B. The panelboards and components shall be UL labeled.

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUAL

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to requirements, provide product by one of the following:

1. Eaton
2. Siemens
3. General Electric
4. Square D
5. Approved Equal

    a. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Ratings.

B. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or panelboard schedules, but not less than 22,000 amperes RMS symmetrical.

C. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or panelboard schedules, but not less than 14,000 amperes RMS symmetrical.

D. Panelboards shall be labeled with a UL short-circuit rating. Series rated panelboards shall be provided with a label or manual stating the conditions of the UL series ratings. Information in the manual shall include, at minimum:

1. Size and type of upstream device
2. Branch devices that can be used
3. UL tested and listed series short-circuit rating.

2.02 CONSTRUCTION

A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three-point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

F. All locks shall be keyed alike.

2.03 BUS

A. Main bus bars shall be tin-plated copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

B. A system ground bus shall be included in all panels.

C. Full-size (100%-rated) insulated stand-off neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.04 BRANCH CIRCUIT PANELBOARDS – CIRCUIT BREAKER

A. The minimum short-circuit rating for branch circuit panelboards shall be 10,000 amperes symmetrical at 240 volts, and 14,000 amperes symmetrical at 480 volts, or as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 1a, Pow-R-Line 2a or Pow-R-Line 3a or approved equal.

B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

C. All circuit breakers shall be thermal-magnetic type with common handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame. Ratings through 100-ampere trip shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.

D. Circuit breaker handle locks (ON position) shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

2.05 BRANCH CIRCUIT PANELBOARDS – FUSIBLE

A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 3FQS, Bussman Type QSCP, or engineer approved equal.

B. Panelboard shall have an integrated spare fuse compartment for up to (6) spare CUBE fuses as standard.

C. Branch circuit disconnecting means shall be bolt-on Bussmann Type CCPB with Bussmann Low-Peak CUBE fuses or approved equal utilized for overcurrent protection. Ratings shall be available from 15-100A with minimum interrupting rating of 300kA symmetrical and 200kA short circuit current assembly rating.

D. Branch circuit devices shall include a non-defeatable interlock to prevent removal of fuse under load. Provide a fuse ampacity rejection feature to prevent over fusing of branch disconnect. Fuses shall be indicating type with permanently installed neon indicating light. Branch devices shall be finger-safe when panelboard trim is removed. Provide lockout/tagout provision for each branch circuit position.

2.06 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

A. Distribution panelboards equipped with bolt-on devices shall have interrupting ratings as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 3a or Pow-R-Line 4B or approved equal. Panelboards shall have molded case circuit breakers as indicated below.

B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

C. Main breakers, if furnished, shall be equipped with microprocessor-based trip units that have integral Arc Flash Reduction trip feature. The use of zone selective interlocking to emulate this function does not meet the intent of this specification and will not be allowed.

D. Distribution circuit breakers shall be fixed mounted type and equipped with either microprocessor-based trip units or thermal magnetic trip units as scheduled on the contract drawings.

E. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.07 DISTRIBUTION PANELBOARDS – FUSIBLE SWITCH TYPE

A. Distribution panelboards shall be equipped with main and branch fusible switches and include fuses with ratings indicated on the drawings. Fusible distribution panelboards shall be Eaton type Pow-R-Line 4F or approved equal.

2.08 PANELBOARD SUBMETERING

A. Where shown on the drawings, supply a UL listed microprocessor-based Multi-Point Metering System (MPM), Eaton type PX Multipoint Meter or approved equal having the specified features.

B. MPM shall have 60 channels for current sensor input. Meter shall auto-detect sensor rating and have standard tamper detection.

C. MPM shall calculate power and energy consumption in accordance with ANSI C12.20 (0.5%) metering specification and store metered data in nonvolatile memory.

D. MPM shall store the following per phase and system total for each metering point.

1. Voltage, Current, and Frequency (system total only)
2. Watts, VAR, VA, and power factor
3. Watt hours including forward and reverse.

E. MPM shall store energy profile information for each metering point in non-volatile memory. The demand profile time period shall be adjustable from 1, 5, 15, 30 and 60 minutes for fixed method and 1, 5, and 15 minutes for sliding method. The MPM shall have the ability to sync with external input to the on-board demand input. The MPM shall be able to save a minimum of 1 year of load profile data for all 60 meter points on a 15 minutes basis.

F. MPM shall be provided with multiple communications ports and protocols, including the following capability:

1. RS-485 remote display port
2. RS-485 Modbus RTU
3. USB Local Configuration Port
4. HTML web pages
5. File transfer protocol (ftp)
6. RJ-45 10/100Base-T Ethernet network port
7. Modbus TCP
8. BACnet/IP
9. SMTP(Simple Mail Transfer Protocol) for email support
10. SNMP(Simple Network Management Protocol) MIB support
11. Ethernet TCP/IP
12. NTP(Network Time Protocol) support

2.09 SURGE PROTECTION DEVICES

A. SPD shall comply with ANSI/UL 1449 4th Edition or later listing by Underwriters Laboratories (UL).

B. SPD shall be factory installed integral to the panelboard by the original equipment manufacturer and shall be a product of the same manufacturer as the panelboard and breakers.

C. The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

D. Electrical Requirements:

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.

3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any

environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.

4. Unit shall operate without the need for an external overcurrent protection device (OCPD) and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.

5. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.

7. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

2.10 ENCLOSURE

A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

B. Enclosures shall be provided with blank ends.

C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.11 NAMEPLATES

A. Provide an engraved nameplate for each panel section as per Specification Section 260553.

2.12 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. Provide typed directory for each panelboard.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262726 – WIRING DEVICES

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install, where indicated, wiring devices, complete with backboxes and wallplates as specified herein, and as shown on the contract drawings.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260500 – Basic Electrical Requirements
C. Section 260532 – Interior Raceways Fittings and Accessories
D. Section 260534 – Outlet, Junction and Pull Boxes

1.03 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Receptacles with integral USB charger.
3. Receptacles with integral Arc Fault Circuit Interrupter, AFCI.
4. Plugload Control Receptacles.
5. Twist-locking receptacles.
6. Receptacles with integral surge-suppression units.
7. Isolated-ground receptacles.
8. Hospital-grade receptacles.
9. Tamper-resistant receptacles.
10. Weather-resistant receptacles.
11. Snap switches and wall-box dimmers.
12. Wall-switch and exterior occupancy sensors.
13. Communications outlets.
14. Pendant cord-connector devices.
15. Cord and plug sets.
16. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.04 DEFINITIONS

A. AFCI: Arc fault circuit interrupter.
B. EMI: Electromagnetic interference.
C. GFCI: Ground-fault circuit interrupter.
D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
E. Plugload Control Receptacle: Automatically occupancy switched receptacle.
F. RFI: Radio-frequency interference.
G. TVSS: Transient voltage surge suppressor.
H. UTP: Unshielded twisted pair.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.06 ACTION SUBMITTALS

A. Product Data: Manufacturer's standard catalog cut, highlighted for each type of product used.

B. Samples: One for each type of device and wall plate specified, in each color specified when so indicated on the drawings or requested by the Architect/Engineer.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. None unless otherwise specified on the drawings.

1.09 QUALITY ASSURANCE

A. Electrical components, conductors, devices and accessories described herein shall be listed and labeled as defined by NFPA 70 by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), for the intended use and shall bear its label.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Incorporated; Wiring Device-Kellems; Wiring Device-Kellems (Hubbell) or a comparable product by one of the following:

1. Arrowhart Wiring Devices, Inc.; Division of Eaton.
2. Leviton Manufacturing Co., Inc.
3. Pass & Seymour/Legrand (Pass & Seymour).
4. Approved equal.

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors shall NOT be used unless otherwise specifically indicated in the drawings.

2.03 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles:

1. Requirements: Heavy Duty 125 V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2. Subject to compliance with requirements, provide product by one of the following:

   a. Hubbell Incorporated; Wiring Device-Kellems; HBL5361 (single), HBL5362 (duplex) (Design Basis)
   b. Arrow Hart Wiring Devices, Inc.; Division of Eaton; 5361 (single), AH 5362 (duplex).
   c. Leviton Manufacturing Co., Inc.; 5361 (single), 5362 (duplex).
   d. Pass & Seymour/Legrand (Pass & Seymour); 5361 (single), 5362 (duplex).
   e. Approved Equal.

B. USB Charging Convenience Receptacles:

1. Requirements: Tamper Resistant, 125 V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596. Compatible with USB 1.1/2.0/3/0 devices, including Apple products.

2. Subject to compliance with requirements, provide duplex receptacle with 2 USB charging Ports or a comparable product by one of the following:

   a. Hubbell Incorporated; Wiring Device-Kellems; USB 20X2 (design basis)
   b. Arrow Hart Wiring Devices, Inc.; Division of Eaton, TR7756.
   c. Leviton Manufacturing Co., Inc. T5832
   d. Pass & Seymour/Legrand (Pass & Seymour) TR5362USB.
   e. Approved Equal

C. Arc Fault Convenience Receptacles:

1. Requirements: 125 V, 20A: tamper resistant. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2. Subject to compliance with requirements, provide product by one of the following:

   a. Hubbell Incorporated; Wiring Device-Kellems; AFR20TR (design basis)
   b. Arrow Hart Wiring Devices, Inc.; Division of Eaton. TRAFCI20
   c. Leviton Manufacturing Co., Inc. AGTR2
   d. Pass & Seymour/Legrand (Pass & Seymour), AFR202
   e. Approved Equal

D. Arc Fault / Ground Fault Dual Function Convenience Receptacles:

1. Requirements: 125 V, 20A, tamper resistant, Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 943, UL 498, and FS W-C-596.

2. Subject to compliance with requirements, provide product by one of the following:

   a. Hubbell Incorporated; Wiring Device-Kellems; AFGF20TR (design basis)
   b. Arrow Hart Wiring Devices, Inc.; Division of Eaton. TRAFCI20
   c. Leviton Manufacturing Co., Inc. AFTR2
   d. Pass & Seymour/Legrand (Pass & Seymour), AFGFR202TR
   e. Approved Equal

E. Plugload Controlled Convenience Receptacles:

1. Requirements: 125 V, 20A, permanent controlled face marking: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2. Subject to compliance with requirements, provide product by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; one controlled face BR20C1, or two controlled faces, BR20C2 (design basis)
b. Arrow Hart Wiring Devices, Inc.; Division of Eaton, 5362CH (one face), 5362CD (2-faces)
c. Leviton Manufacturing Co., Inc. 5362-S1(one face) or 5362-S2 (two faces)
d. Pass & Seymour/Legrand (Pass & Seymour).5362CH (1-face) or 5362CD (2-faces)
e. Approved Equal.

F. Isolated-Ground, Duplex Convenience Receptacles:

1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2. Requirements: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

3. Subject to compliance with requirements, provide or a comparable product by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; IG5362 (design basis)
b. Arrow Hart Wiring Devices, Inc.; Division of Eaton; IG 5362.
c. Leviton Manufacturing Co., Inc.; 5362IG.
d. Pass & Seymour/Legrand (Pass & Seymour); IG5362.
e. Approved Equal.

G. Tamper-Resistant Convenience Receptacles:

1. Requirements: 125 V, 20 A: Comply with NEMA WD1, NEMA WD6 Configuration 5-20R, UL 498 Supplements, and FSW-C-596.

2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

a. Hubbell Wiring Device - Kellems; HBL5362TR (design basis)
b. Arrow Hart Wiring Devices, Inc.; Division of Eaton; TRBR20.
c. Leviton Manufacturing Co., Inc.; TBR20.
d. Pass & Seymour/Legrand (Pass & Seymour); TR63.
e. Approved equal.

2.04 GFCI RECEPTACLES

A. Description:

1. Straight blade, non-feed-through type unless otherwise specified in the drawings.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.

3. Self-test function, line / load reversal protection.

4. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

5. Extra heavy duty, weather and tamper resistant.

6. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

7. Subject to compliance with requirements, provide product by one of the following:

    a. Hubbell Incorporated; Wiring Device-Kellems; GFR5632TR (design basis).
    b. Cooper Wiring Devices, Inc.; Division of Eaton; VGF20.
    c. Leviton Manufacturing Co., Inc.; 7899.
    d. Pass & Seymour/Legrand (Pass & Seymour); 2099.
    e. Approved Equal

2.05 RETRACTABLE CORD REELS

A. General Requirements:

1. Comply with NEMA WD 1, UL 20, and FS W-S-896.
2. Switches, 120/277 V, 20 A, 1HP @ 120V, 2HP @ 240V:

B. Description:

1. Steel construction including mounting base, 20A, 125VAC, NEMA 2 positive latching mechanism, minimum 5’ long input power cord and plug, adjustable guide arm, 25’L minimum 12/3 power cord.

2. UL 355 listed / certified.

3. Provide with double duplex GFCI straight blade receptacles on the payout end. Exception – Integral GFCI protection not required where upstream GFCI protection is provided by a GFCI branch circuit breaker or other device.

4. Unless otherwise noted in the drawings provide safety yellow color when used in shop classrooms, white when used in Science lab or Family/Consumer Science classrooms.

5. Provide with swivel base.

6. Subject to compliance with requirements, provide product by one of the following:

    a. Hubbell Incorporated; Wiring Device-Kellems; HBL45123 Series (design basis)
    b. KH Industries RTB3L Series.
    c. Approved equal.

2.06 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.07 TOGGLE SWITCHES

A. General Requirements:

1. Comply with NEMA WD 1, UL 20, and FS W-S-896.
2. Switches, 120/277 V, 20 A, 1HP @ 120V, 2HP @ 240V:

B. Single Pole:

1. Subject to compliance with requirements, provide product by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; 1221 (design basis)
b. Arrow Hart Wiring Devices, Inc.; Division of Eaton, Inc.; AH 1221.
c. Leviton Manufacturing Co., Inc.; 1221-2.
d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC1.
e. Approved equal.

C. Double Pole:

1. Subject to compliance with requirements, provide or a comparable product by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; 1222 (design basis)
b. Arrow Hart Wiring Devices, Inc.; Division of Eaton, Inc.; AH1222.
c. Leviton Manufacturing Co., Inc.; 1222-2.
d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC2.
e. Approved equal.

D. Three Way:

1. Subject to compliance with requirements, provide or a comparable product by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; 1223 (design basis)
b. Arrow Hart Devices, Inc.; Division of Eaton.; AH1223.
c. Leviton Manufacturing Co., Inc.; 1223-2.
d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC3.
e. Approved equal.

E. Four Way:

1. Subject to compliance with requirements, provide product by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; 1224 (design basis)
b. Arrow Hart Wiring Devices, Inc.; Division of Easton.; AH1224.
c. Leviton Manufacturing Co., Inc.; 1224-2.
d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC4.
e. Approved equal.

F. Pilot-Light Switches:

1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off.

2. Subject to compliance with requirements, provide product by one of the following:

    a. Hubbell Incorporated; Wiring Device-Kellems; 1221-PL for 120 and 277 V
    b. Arrow Hart Wiring Devices, Inc.; Division of Eaton.; AH1221-PL (120 ad 277 V).
    c. Leviton Manufacturing Co., Inc.; 1221-PLR (120V) or 1221-7PLR (277V).
    d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC1RPL (120V) or PS20AC1RPL7 (277V).
    e. Approved equal.

G. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

    1. Subject to compliance with requirements, provide product by one of the following:

        a. Hubbell Incorporated; Wiring Device-Kellems; HBL1557 (design basis)
        b. Arrow Hart Devices, Inc.; Division of Eaton.; 1995.
        c. Leviton Manufacturing Co., Inc.; 1257.
        d. Pass & Seymour/Legrand (Pass & Seymour); 1251.
        e. Approved equal.

2.08 KEY-OPERATED SWITCHES, 120/277 V, 20 A

A. General Requirements:

    1. Comply with NEMA WD 1, UL 20, and FS W-S-896.

    2. Switches, 120/277 V, 20 A, 1HP @ 120V, 2HP @ 240V.

    3. Single Pole, with factory-supplied key in lieu of switch handle.

B. Single Pole:

    1. Subject to compliance with requirements, provide product by one of the following:

        a. Hubbell Incorporated; Wiring Device-Kellems; 1221L (design basis)
        b. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1221L.
        c. Leviton Manufacturing Co., Inc.; 1221-2L.
        d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC1-L.
        e. Approved equal.

C. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

    1. Subject to compliance with requirements, provide product by one of the following:

        a. Hubbell Incorporated; Wiring Device-Kellems; HBL1557L (design basis)
        b. Arrow Hart Wiring Devices, Inc.; Division of Eaton.; 1995L.
        c. Leviton Manufacturing Co., Inc.; 1257L.
        d. Pass & Seymour/Legrand (Pass & Seymour); 1251L.
        e. Approved equal.

2.09 WALL-BOX DIMMERS

A. Shall be compatible with lighting type used. Coordinate with drawings and lighting specification divisions.

2.10 WALL PLATES

A. Single and combination types shall match corresponding wiring device style. Multi-gang installations shall be installed under a single piece wall plate.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Type 302 stainless steel, 0.04-inch thick, brushed brass with factory polymer finish.

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, listed and labeled for use in wet and damp locations.

5. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.11 FLOOR SERVICE FITTINGS

A. Floor Service assemblies specified herein shall be for power use only. For assemblies containing data communications or combination power and data communications refer to technology drawings and specification sections for applicable products.

B. Type: Modular, flush-type, flap-type, above-floor, single-service units suitable for wiring method used as indicated in the drawings.

C. Compartments: Barrier separates power from voice and data communication cabling.

D. Service Plate: Rectangular or Round as indicated, finish die-cast aluminum finish with satin finish, unless otherwise indicated.

E. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

2.12 POKE-THROUGH ASSEMBLIES

A. Poke–Through assemblies specified herein shall be for power use only. For assemblies containing data communications or combination power and data communications refer to technology drawings and specification sections for applicable products.

B. Where not otherwise indicated on the drawings, subject to compliance with requirements, provide Hubbell Incorporated; Wiring Device-Kellems; products named below or a comparable product by one of the following:

1. FSR.
2. Wiremold / Legrand.
3. Approved equal.

C. Activation Type:

1. Recessed Activation.

a. Hubbell System One - Recessed Activation or approved equal.

1) S1R4PT: 4-inch core with two 1/2 inch and one 3/4 inch feed conduits.
2) Outlets: S1R4PTQUAD: Power only, with four power outlets.

b. Provide with appropriate subplate for device mounting and cover, finish chosen by Architect.

1) Cover Flange: 0.12 inch thick, ADA compliant.
2) Finish: As specified by Architect.

D. Surface Activation.

1. Hubbell System One - Surface Activation or approved equal:

a. S1PT4X4FIT with two 3/4 inch conduits for low voltage, one 3/4 inch for power.

2. Provide with appropriate subplate for device mounting and cover, finish chosen by Architect.

3. Cover Flange: ADA compliant appropriate for use in the floor finish installed.

4. Furniture Feed Cover: S1PFFT for tile applications or S1PFF for carpet applications as appropriate with one 3/4 inch connection for power and one 1-1/2 inch connection for low voltage.

a. Finish: As specified by Architect.

E. Pedestal Activation.

1. PT7XC, 2-inch poke through insert with a RX80 series pedestal, size as required or approved equal.

F. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

2. Comply with UL 514 scrub water exclusion requirements.

3. Service-Outlet Assembly: As indicated on the plans."

4. Size: Selected to fit cored holes in floor and matched to floor thickness.

5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

6. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.

7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors

2.13 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Unless otherwise noted in the drawings, Subject to compliance with requirements, provide 20A, 120V by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems; Plug TrakHBL24 series steel.
b. Wiremold / Legrand.
c. Approved equal.

B. Two-piece surface painted steel brushed aluminum or PVC raceway, with factory-wired multi-outlet harness.

C. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Painted Metal for general use. PVC where subject to corrosive conditions.

E. Multi-outlet Harness:

1. Receptacles: 20 A, 125-V, NEMA WD 6 Configuration 5-20R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.

2. Receptacle Spacing: 12 inches, unless otherwise indicated.

3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

2.14 SERVICE POLES

A. Subject to compliance with requirements, provide service poles or comparable product by one of the following:

1. Hubbell Wiring Device Kellems; HBL PP series (design basis)._
2. MonoSystems.
3. Legrand / Wiremold.
4. Approved equal.

B. Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

2. Poles: Nominal 2.5-inch- square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.

3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.

4. Material and Finish: Painted steel.

5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 3 or Category 5 voice and data communication cables.

6. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.

7. Voice and Data Communication Outlets: complying with requirements in Division 27.

2.15 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Brown unless otherwise indicated or required by NFPA 70 or device listing. Exceptions – a) In offices, Libraries, Cafeterias, etc., color as specified by Architect, b) In partially renovated rooms - match existing devices to remain.

2. Wiring Devices Connected to Emergency / Standby Power System: Red.

3. TVSS Devices: Blue.

4. Isolated-Ground Receptacles: White, with orange triangle on face.

5. Controlled Receptacles – Green (where available) or where not available, other color differing from general use receptacles in the area.

B. Wall Plate Color: See “Wallplates” above. For plastic covers, match device color.

PART 3 – EXECUTION

3.01 INSTALLATION

A. See plans for device mounting heights. Otherwise, comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Install devices flush and level.

2. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

3. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

4. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

5. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

6. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
7. Use a torque screwdriver when a torque is recommended or required by manufacturer.

8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

9. Tighten unused terminal screws on the device.

10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

11. Receptacles shall have a bonding conductor from the grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not acceptable.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to left.

F. Wall Switches:

1. Install wall switches with OFF position down.

G. Device Plates:

1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

2. Install device plates flush and level.

H. Dimmers:

1. Install dimmers within terms of their listing.

2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

4. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.

5. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

A. Comply with Section 260553 – Identification for Electrical Systems.

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

A. Tests for Wiring Devices:

1. Inspect each wiring device for defects.

2. Verify each receptacle device is energized. Acceptable line voltage range is 105 to 132 V.

3. Test each receptacle for proper polarity. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Operate each wall switch and wall dimmer with circuit energized and verify proper operation.

7. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262816 – HEAVY DUTY SAFETY SWITCHES

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the low-voltage fused and non-fused switches as specified herein and as shown on the contract drawings.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260500 – Common Work Results for Electrical
C. Section 260553 – Identification for Electrical Systems

1.03 REFERENCES

A. The switches and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards:

1. NEMA KS-1
2. UL 98

1.04 SUBMITTALS – FOR REVIEW / APPROVAL

A. The following information shall be submitted to the Engineer:

1. Dimensioned outline drawing
2. Conduit entry/exit locations
3. Switch ratings including:

    a. Short-circuit rating
    b. Voltage
    c. Continuous current

4. Fuse ratings and type
5. Cable terminal sizes
6. Product data sheets

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process.

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 REGULATORY REQUIREMENTS

A. The safety switches shall bear a UL label.

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 QUALITY ASSURANCE

A. Electrical components, conductors, devices and accessories described herein shall be listed and labeled as defined by NFPA 70 by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), for the intended use and shall bear its label.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to the requirements listed herein, provide product by one of the following:

1. Eaton
2. Siemens
3. General Electric
4. Square D
5. Approved Equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 HEAVY-DUTY SAFETY SWITCHES

A. Provide switches as shown on drawings, with the following ratings:

1. 30 to 1200 amperes
2. 240 volts ac; 600 volts ac
3. 2 and 3 poles
4. Fusible and non-fusible
5. Mechanical lugs suitable for aluminum or copper conductors.

B. Construction

1. Switch blades and jaws shall be visible and plated copper.
2. Switches shall have a red handle that is easily pad-lockable with three 3/8-inch shank locks in the OFF position.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the handle is in the ON position (except for double-throw switches). Defeater mechanism shall be front accessible.

4. Switches shall have deionizing arc chutes.
5. Switch assembly and operating handle shall be an integral part of the enclosure base.
6. Switches rated 30 A to 600 A shall have reinforced fuse clips.
7. Switch blades shall be readily visible in the “ON” and “OFF” position.
8. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable.
9. Fusible switches shall be suitable for service entrance equipment (except for 4-pole switches and 1200 A when used on 480Y/277 or 600Y/347 grounded WYE systems)
10. Switches shall have line terminal shields (except for non-fusible double throw switches)
11. Switches shall be suitable for systems capable of 200 kA at 480 V with Class J, L, R, or T fusing as applicable for single-throw switches; Embossed or engraved ON-OFF indication shall be provided.
12. Double-make, double-break switch blade feature shall be provided.
13. Fuse pullers shall be provided on all NEMA 4X and 12 switches through 200 A
14. Renewal parts data shall be shown on the inside of the door.

C. Enclosures

1. All enclosures shall be NEMA 1 general purpose, for indoor use, unless otherwise noted.
2. Enclosures shall be NEMA 3R, rainproof, for outdoor or wet location use, unless otherwise noted,

    a. Enclosures shall NEMA 4X watertight corrosion-resistant; either 304 or 316 stainless steels, or fiberglass where and as indicated in the drawings.
    b. 30 A to 100 A NEMA 4X, and 12/3R enclosures shall be provided with draw-pull latches.

D. The following factory modifications are to be included:

1. Phenolic nameplates
2. Fungus proofing
3. Lock ON provisions
4. Factory installed neutral assemblies.
5. Class R fuse clips factory installed (30A - 600A)
6. Factory installed ground lug kits.

E. Provide fused switches with:

1. (1) complete set of fuses installed.
2. (1) complete set of fuses as spares.
3. (1) Fuse puller

2.03 SOLAR DISCONNECT SWITCHES

A. Provide 30- to 600-ampere switches as shown on the drawings for solar installations with the following ratings and characteristics:

1. Switches shall be UL listed for 600 VDC and shall be wired according to the listing instructions. Switches shall be wired with one circuit per switch. Multiple circuits shall not be permitted to be switched with a single mechanism.

2. NEMA enclosure shall be NEMA 3R, 12 or 4X as shown on the drawings.

3. Switches shall be listed as “Suitable for NEC Article 690 Applications” and shall be labeled with the maximum solar string as per NEC calculations.

4. Switches that can be energized from both the line and load side shall be marked:

WARNING
ELECTRIC SHOCK HAZARD
DO NOT TOUCH TERMINALS
TERMINALS ON BOTH THE LINE
AND LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION

5. Switches shall be supplied with a clear, factory-installed dead-front shield to guard against accidental contact with line or load terminals.

6. Switches shall have a factory-installed neutral block for terminating grounded conductors, and switches shall have a separate lug for equipment grounding conductors.

7. Fusible switches shall be equipped with Class R fuse clips as standard.

8. Fusible switches shall be supplied with one set of fuse clips only, and fuse holders must be isolated from any potential source when the handle is in the “off” position.

2.04 NAMEPLATES

A. Nameplate shall be front cover mounted, containing a permanent record of switch type, ampere rating, and maximum voltage rating.

B. Provide identification plate as indicated in Section 260553 – Identification for Electrical Systems.

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

3.02 INSTALLATION

A. The equipment shall be installed per the manufacturer’s recommendations and all NEC and local code requirements.

B. Install fuses such that fuse rating information can be read without removing fuse.

3.03 TOUCH-UP PAINTING

A. Provide touch-up painting to restore and refinish to match original condition surfaces of electrical equipment scratched, marred during shipping, handling or installation. Remove any rust and prime and paint as recommended by manufacturer.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 265100 – INTERIOR LIGHTING

PART 1 – GENERAL

1.01 SCOPE

A. This section includes furnishing, installing and connecting interior lighting systems.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 01 Specification Sections, and other applicable Specification Sections, the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Section 260500 – Common Work Results for Electrical
2. Section 260519 – Low-Voltage Electrical Power Conductors & Cables
3. Section 260526 – Grounding and Bonding

1.03 DEFINITIONS

A. Lighting Fixture: An electrical device that contains one or more lighting elements which provide illumination. The terms “lighting fixture”, “fixture” “luminaire” carry the same meaning.

B. Night Lights: Light fixtures that are wired to the unswitched leg of the circuit. Night lights are not to be confused with emergency lights, which have a second source of power and may be switched.

1.04 SUBMITTALS

A. Product Data: Arrange in order of luminaire designation. The submittals shall include data on features, ratings, listings, certifications, accessories, finishes, dimensions, emergency components, photometric data, and luminaire efficiency data.

B. Manufacturer standard cut sheets fully highlighted or red-lined with selected features and options.

C. Closeout Submittal: Installation, Operation, and Maintenance Manuals.

D. Substitutions and/or equivalents: Where substitute or equivalent fixtures are proposed for use by the Contractor, and upon request of the Engineer or Architect, provide complete site-specific point by point photometric analysis of the proposed fixtures. The analysis shall be provided at no additional cost. Floor plan backgrounds will be provided by the Engineer /Architect upon request. Results shall include for each space:

1. Average illumination levels (in footcandles.)
2. Max/min ratios
3. Power density (Watts/sq.ft.)
4. Legend and schedule of proposed fixtures which includes lumen output per fixture, watts per fixture.
5. Fixture mounting heights (ft.).
6. Any de-rating factors applied.
7. Point by point plot of illumination levels at not more than 2’ x 2’ spacing.

1.05 QUALITY ASSURANCE

A. Lighting fixtures shall be of specification grade and listed or labeled by Underwriters Laboratories (UL) or an approved Nationally Recognized Testing Laboratory (NRTL).

B. LED fixtures shall comply with the following:

1. UL Standard 8750 “Light Emitting Diode Equipment for Use in Lighting Products”, IES Standard LM-79 “Electrical and Photometric Measurements of Solid-State Lighting Products”, IES Standard LM-80 “Measuring Lumen Maintenance of LED Light Sources”, and IES Standard TM-21 “Projecting Long Term Lumen Maintenance of LED Light Sources”.

2. ANSI C78.377 “Specifications for the Chromaticity of Solid State Lighting Products” with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

1.06 WARRANTY

A. For non-LED lighting fixtures and components, provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.

B. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 LIGHTING FIXTURES

A. Provide lighting fixtures in accordance with the Fixture Schedule.

1. Provide only LED fixtures with a Design Lights Consortium (DLC) listing, a U.S. Department of Energy (DOE) “LED Lighting Facts” label, or a U.S. Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.

B. Unless otherwise specified, LED fixtures shall have a color temperature of 3500 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.

C. Recessed lighting fixtures shall be thermally protected.

D. LED fixtures shall be modular and allow for separate replacement of LED light elements and drivers. User serviceable LED light elements and drivers shall be replaceable from the room side.

E. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings.

2.02 LAMPS

A. Unless otherwise specified, LED lamps shall have a color temperature of 3500 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.

B. Retrofit LED lamps shall comply with NEMA SSL 4 “SSL Retrofit Lamps: Suggested Minimum Performance Requirements”.

2.03 BALLASTS AND DRIVERS

A. LED drivers shall be electronic type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

B. Dimmable LED drivers shall be 0-10V type, unless otherwise noted. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

C. Ballasts and drivers shall be rated for the ambient temperatures in which they are located. Outdoor fixtures shall be equipped with ballasts or drivers rated for reliable starting to -20 degrees F. Indoor fixtures located in areas with direct sunlight or above normal ambient temperatures shall have ballasts or drivers rated at 65 degrees C minimum.

D. Individually fused ballasts and drivers shall have their fuses accessible from outside of the fixture chassis.

2.04 EMERGENCY LIGHTING

A. Emergency lighting shall consist of normal lighting fixtures with generator or battery-inverter system backup, emergency lighting fixtures with individual battery backup, or sealed beam emergency lighting units in accordance with the Fixture Schedule.

B. Emergency lighting fixtures shall be capable of providing the listed emergency illumination for not less than 90-minutes after loss of normal power.

1. Battery-backed LED emergency lighting fixtures shall consist of a normal LED fixture with some or all the LEDs connected to a UL 924 Listed battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted to be visible to the public. The fixture shall not contain an audible alarm.

2. Sealed beam emergency lighting units shall be UL 924 Listed, dual voltage 120/277V input, and shall consist of sealed beam LED lamps connected to an internally mounted battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of battery operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The unit shall be suitable for wall or ceiling mounting as required. It shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The unit shall include a test/monitor module with LED status indicating lights mounted to be visible to the public. The unit shall not contain an audible alarm.

2.05 EXIT SIGNS

A. Exit signs shall be of the LED type. Fluorescent, electro luminescent light panel, or self-powered luminous signs shall not be used. Subject to requirements, provide product from Chloride, Dual-Lite, Emergi-Lite, Exide Lightguard, Lightalarms, Lithonia, LSI Industries, Morelite, Prescolite, or Sure-Lites or approved equal.

1. Dual Voltage Input 120/277V, 60Hz., UL 924 Listed, UL Damp Location Listed.

2. LED’s shall be wired in parallel to prevent multi-lamp failure and shall be concealed within the sign by a clear panel and red optical diffuser. Power consumption shall not exceed 2 watts per face.

3. Exit signs shall have white die-cast aluminum or polycarbonate housings with universal mounting brackets; brushed aluminum stencil faces with red or green letters and multi-directional knockout arrows.

4. Exit signs shall be provided with extra faceplate for field conversion from single to double face.

5. Exit signs shall be provided with UL 924 Listed, 90-minute emergency battery packs and battery chargers when required. Batteries shall be maintenance-free nickel-cadmium and shall be mounted within the signs.

6. Shall include integral test switch and power indicator light.

7. New exit signs in installed existing buildings shall match the existing exit sign color scheme (red or green)

2.06 COMBINATION EMERGENCY / EXIT SIGNS

A. Combination emergency / exit signs shall be subject to the requirements outlined for sealed beam emergency lights and exit lights as described above. Subject to requirements, provide product from Chloride, Dual-Lite, Emergi-Lite, Exide Lightguard, Lightalarms, Lithonia, LSI Industries, Morelite, Prescolite, or Sure-Lites or approved equal.

2.07 LOW VOLTAGE LIGHTING CONTROL WIRING

A. 0-10VDC Dimming Control Wiring:

1. UL TYPE CMP/CL3P/FPLP plenum rated cable, 300V, 75CC
2. 16AWG or 18AWG stranded copper conductors,
3. White outer jacket, (2) conductors - violet and pink
4. Southwire Spec #70194 or equal

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Comply with NFPA 72, NECA 1 and manufacturer’s installation instructions.

B. Support recessed troffers independently of the ceiling grid system by using two safety wires minimum on diagonally opposite corners of the fixtures. Support recessed downlights by using safety wires or by rigidly attaching the fixtures to the building structure or ceiling grid system. Removable T-bar clips shall not solely be used to attach fixtures to the ceiling grid system.

C. Install fixtures level, with no gaps between adjacent fixtures or between fixtures and surrounding surfaces. Lenses, reflectors, and trims of fixtures shall be properly and uniformly aligned.

D. Where fixtures are shown with dual switches, control all inner lamps with one switch and all outer lamps with the other switch. Where dimming or occupancy sensor-controlled fixtures are shown, control the fixtures in accordance with the appropriate wiring diagram or manufacturer's instructions.

E. Connect night light fixtures and emergency lighting fixtures to the hot (unswitched) side of the area lighting circuits.

F. Provide an individual feed with ground conductor from a junction box to each lighting fixture. Lighting fixtures shall not be daisy chained.

G. Drops to recessed fixtures may be flexible metallic conduit, or manufactured wiring systems may be used where accessible. Fixtures shall be provided with sufficient length to permit removal and lowering of the fixtures 12” below the ceiling.

H. Provide green grounding conductors back to the panel ground for lighting circuits. Raceways shall not be used as grounding conductors.

I. Fixtures shall have their exterior labels removed and shall be thoroughly cleaned. Burned out lamps or arrays shall be replaced. Cracked or damaged lenses shall be replaced.

J. Locate emergency lighting remote battery packs and remote test/monitor modules identically so their status indicating lights are visible to the public and they form a straight line when viewed from the end of the corridor or room. Where a suspended ceiling exists, center the status indicating lights in adjacent ceiling tiles.

K. Mount sealed beam emergency lighting units where shown and aim their lamps to light the egress path as uniformly as possible.

L. When emergency lighting fixtures contain audible alarms, disable the alarms in accordance with manufacturer's instructions.

M. Sealed beam emergency lighting unit fixtures and the emergency supply of emergency battery/inverter fixtures shall be wired to the area lighting circuit ahead of any switching controls. Exception, when three or more normal lighting circuits supply a separate and uninterrupted area, that may be supplied from a separate dedicated circuit from the same panel and provided with a lock-on circuit breaker.

N. Clean all fixtures of construction dust and fingermarks prior to final inspection.

3.02 FIELD QUALITY CONTROL

A. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected and rattles due to ventilation system vibration shall be eliminated. Damaged or broken lenses shall be replaced.

B. Perform an operational test to verify that all fixtures illuminate properly, dimming systems dim properly (i.e. no flicker), and lighting zones are switched according to the drawings.

C. Test all emergency and exit lighting by interrupting the normal lighting supply to verify proper operation. Verify proper re-transfer to normal operation upon restoration of normal power.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 265600 – EXTERIOR LIGHTING

PART 1 – GENERAL

1.01 SCOPE

A. This section includes furnishing, installing and connecting exterior lighting systems.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 01 Specification Sections, and other applicable Specification Sections, the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Section 260500 – Common Work Results for Electrical
2. Section 260505 – Low-Voltage Electrical Power Conductors & Cables
3. Section 260526 – Grounding and Bonding
4. Section 260543 – Underground Ducts and Raceways for Electrical Systems

1.03 DEFINITIONS

A. Lighting Fixture: An electrical device that contains one or more lighting elements which provide illumination. The terms “lighting fixture”, “fixture” “luminaire carry the same meaning.

1.04 SUBMITTALS

A. Product Data: Arrange in order of luminaire designation. The submittals shall consist of manufacturer’s standard catalog cuts and shall include data on features, ratings, listings, certifications, accessories, finishes, dimensions, emergency components, photometric data, and luminaire efficiency data.

B. Manufacturer standard cut sheets shall be fully highlighted or red-lined with selected features and options to be provided.

C. Installation, Operation, and Maintenance Manuals.

D. Substitutions and/or equivalents: Where substitute or equivalent fixtures are proposed for use by the Contractor, and upon request of the Engineer or Architect, provide complete site-specific point by point photometric analysis of the proposed fixtures. The analysis shall be provided at no additional cost. Floor plan backgrounds will be provided by the Engineer /Architect upon request. Results shall include for each space:

1. Average illumination levels (in footcandles.)
2. Max/min ratios
3. Power density (Watts/sq.ft.)
4. Legend and schedule of proposed fixtures which includes lumen output per fixture, watts per fixture.
5. Fixture mounting heights (ft.).
6. Any de-rating factors applied.
7. Point by point plot of illumination levels at not more than 2’ x 2’ spacing.

1.05 QUALITY ASSURANCE

A. Lighting fixtures shall be of specification grade and listed or labeled by Underwriters Laboratories (UL) or an approved Nationally Recognized Testing Laboratory (NRTL).

B. LED fixtures shall comply with the following:

1. UL Standard 8750 “Light Emitting Diode Equipment for Use in Lighting Products”, IES Standard LM-79 “Electrical and Photometric Measurements of Solid-State Lighting Products”, IES Standard LM-80 “Measuring Lumen Maintenance of LED Light Sources”, and IES Standard TM-21 “Projecting Long Term Lumen Maintenance of LED Light Sources”.

2. ANSI C78.377 “Specifications for the Chromaticity of Solid-State Lighting Products” with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

1.06 WARRANTY

A. For non-LED lighting fixtures and components, provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.

B. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 POLES

A. General:

1. Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.

2. The pole and arm assembly shall be designed for wind loading of 100 mph minimum, as required by wind loading conditions at project site, with an additional 30% gust factor and supporting luminaire(s) and accessories such as shields, banner arms, and banners that have the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base, as shown on the drawings.

3. Poles shall be anchor-bolt type designed for use with underground supply conductors. Poles shall have handhole having a minimum clear opening of 2.5 x 5 inches. Handhole covers shall be secured by stainless steel captive screws.

4. Provide a steel-grounding stud opposite handhole openings, designed to prevent electrolysis when used with copper wire.

5. Provide a base cover that matches the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.

6. Hardware and Accessories: All necessary hardware and specified accessories shall be the product of the pole manufacturer.

7. Provide manufacturer's standard finish, as scheduled on the drawings.

B. Types:

1. Aluminum: Provide round or square aluminum poles as indicated in the drawings manufactured of corrosion-resistant AA AAH35.1 aluminum alloy conforming to AASHTO LTS-4. Poles shall be seamless extruded or spun seamless type.

2. Steel: Provide round or square steel poles having minimum 11-gauge steel with minimum yield/strength of 48,000 psi and factory finish. Galvanized steel poles shall comply with ASTM A123 and A153.

C. Foundations for Poles:

1. Foundations shall be cast-in-place concrete, or pre-cast concrete, having 4000 psi minimum 28-day compressive strength.

2. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as shields, banner arms, and banners, under wind conditions previously specified in this section.

3. Place concrete in spirally wrapped treated paper forms for round foundations, and construct forms for square foundations.

4. Rub-finish and round all above-grade concrete edges to approximately 6 mm (0.25-inch) radius.

5. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tiewire to stirrups. Anchor bolts shall be positioned as per the pole manufacturer requirements.

6. Prior to concrete pour, install electrode per Section 260526 - GROUNDING AND BONDING.

7. Only pole manufacturer supplied, or approved anchor bolts may be used in pole foundations.

8. Pre-cast concrete foundations, conforming to the drawings may used in lieu of cast-in place foundations.

2.02 LIGHTING FIXTURES

A. Provide lighting fixtures in accordance with the Fixture Schedule.

B. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and driver/ballast heat, and safe cleaning and re-lamping.

C. Provide fixtures with all required mounting hardware, backboxes, adapters, etc. to mount fixtures to poles, walls etc.

D. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.

E. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.

F. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

G. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61-09 and UL 496-08.

H. Pre-wire internal components to terminal strips at the factory.

I. Bracket-mounted luminaires shall have levelling provisions and clamp-type adjustable slip-fitters with locking screws.

J. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

K. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials.

L. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.03 LAMPS

A. Where lamps are furnished separately, install the proper lamps in every luminaire installed and every existing luminaire relocated or reinstalled as shown on the drawings.

B. Lamps shall be general-service, outdoor lighting types.

C. High-Pressure Sodium (HPS) Lamps: Comply with NEMA C78.42, Color Rendering Index (CRI) 21 (minimum), wattage as indicated on fixture schedule. Lamps shall have minimum average rated life of 24,000 hours.

D. Metal-Halide Lamps: Comply with NEMA C78.43 or NEMA C78.1381. Lamps shall be pulse start or ceramic type with wattage and correlated color temperature as indicated on fixture schedule.

E. LED sources shall meet the following requirements:

1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).

2. Correlated Color Temperature (CCT): 5000K unless otherwise specified in the drawings.

3. Color Rendering Index (CRI): greater than or equal to 85.

4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.

F. Mercury vapor lamps shall not be used.

2.04 BALLASTS AND DRIVERS

A. LED drivers shall be electronic type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

B. Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

C. Ballasts and drivers shall be rated for the ambient temperatures in which they are located. Outdoor fixtures shall be equipped with ballasts or drivers rated for reliable starting to -20 degrees F. Indoor

fixtures located in areas with direct sunlight or above normal ambient temperatures shall have ballasts or drivers rated at 65 degrees C minimum.

D. Individually fused ballasts and drivers shall have their fuses accessible from outside of the fixture chassis.

2.05 EMERGENCY LIGHTING

A. Provide emergency egress lighting where indicated on the drawings.

B. Emergency lighting shall consist of normal lighting fixtures with generator or battery-inverter system backup, emergency lighting fixtures with individual battery backup, or sealed beam emergency lighting units in accordance with the Fixture Schedule.

C. Emergency lighting fixtures shall be capable of providing the listed emergency illumination for not less than 90-minutes after loss of normal power.

1. Battery-backed LED emergency lighting fixtures shall consist of a normal LED fixture with some or all the LEDs connected to a battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted to be visible to the public. The fixture shall not contain an audible alarm. Batteries used outdoors shall be cold weather rated (-4 ^{o}F).

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

B. Pole Foundations:

1. Excavate only as necessary to provide sufficient working clearance for installation of forms or foundation and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.

2. Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3. After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 9 mm (0.375-inch) inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.

C. Install lamps in each luminaire requiring lamping.

D. Adjust and aim luminaires that require aiming.

E. Wall-Mounted Fixtures:

1. Install per NEC, the drawings and manufacturer's instructions.
2. Provide all required mounting hardware.
3. Install fixtures on suitable listed backboxes.
4. All building penetrations shall be thoroughly caulked and sealed watertight.

3.02 GROUNDING

A. Install grounding fort exterior lighting using materials and methods specified in Section 16060 Grounding and Bonding.

B. Install a 10-foot-long x 3/4" diameter copper clad ground rod at each pole.

C. Connect the ground lug of metal pole to the ground rod using a #6 AWG copper conductor. Where the copper grounding conductor is connected to metal other than copper, provide bi-metallic connectors listed for this purpose.

3.03 FIELD QUALITY CONTROL

A. Verify operation of fixtures and controls after installing and energizing circuits.

END OF SECTION

DIVISION 27 – COMMUNICATIONS

SECTION 271501 – COMMUNICATIONS AND HORIZONTAL CABLING

PART 1 – GENERAL

1.01 GENERAL NOTES

A. The intent of the specification section is to outline the scope of work products and execution relating to furnishing and installing Network Cabling at the new or remodeled buildings and/or building additions. This includes but is not limited to Backbone and Horizontal cabling comprised of Copper and Fiber Cabling, and support systems are covered under this document and the Electrical Contractor shall complete as part of their bid and subsequent required design, implementation, service and installation.

B. All work associated with Division 27 and its intent shall be coordinated with all other work as furnished and installed by other trades that may or may not interface, interact or be dependent upon the work herein.

C. The Electrical contractor shall meet all required deadlines for installation and implementation and shall notify the Architect/Engineer of any difficulty that he or she faces that may alter these deadlines.

D. The Electrical Contractor shall also notify the Architect/Engineer or the Owner’s designated representative of any design discrepancy, site limitation, or configuration, which would prohibit the contractor from a successful and timely installation. Failure to notify these parties shall result in the contractor's sole responsibility for it.

E. The Electrical Contractor shall be solely responsible for ascertaining, determining and subsequently paying the appropriate prevailing wage rates for the work herein. The Architect/Engineer and the Owner will be held harmless from these and any decisions that the contractor reaches that pertain to the contractor's work.

F. The Electrical Contractor shall be responsible for the copper and fiber data cable, cable management and terminations of such as shown on all E/T series drawings.

G. The Electrical Contractor shall be responsible for the data power and surface raceway as shown on all E/T series drawings.

H. All technology power and data wiring shall be performed by the Electrical Contractor. All references made to the Division 27 Contractor shall mean the electrical contractor.

1.02 PROJECT DESCRIPTION

A. The Network Infrastructure Design is as follows:

1. Category 6/6A UTP and STP cabling to the Workstation Locations.

B. Category 6/6A Unshielded Twisted Pair Copper cabling shall be used to connect the workstations to the nearest Telecommunications Closet (TR), Category 6/6A Unshielded Twisted Pair Copper cabling shall be used for the horizontal structured cabling.

1.03 BIDDERS QUALIFICATIONS

A. All prospective Bidders must possess a minimum of five (5) years continuous experience as a firm doing business under the same name, engaged principally as a contractor for the work proposed.

B. All prospective Bidders must maintain an experienced technical and in house organization for the project, and must maintain an office facility with full-time employees in a commercial space.

C. All data wire installers shall be certified CAT 6/6A and Fiber installers, and the contractor shall provide copies of the certifications from manufactures of UTP/STP copper cabling systems and optical fiber cabling systems such as Hitachi Cable of America or equivalent.

D. All systems, equipment or products herein specified shall be provided and installed by an Authorized Factory Installer for this system, equipment or product.

E. All prospective Bidders shall be able to provide the Owner with the appropriate manufacturer's warranty and service on the proposed equipment. Structured cable manufacturer's warranty shall be a minimum of 20 years.

F. All prospective Bidders will maintain a staff of trained, certified technicians for equipment being specified for this project.

G. A minimum of five years' experience in the application of specified equipment is required.

H. A list of projects completed within the last year with contact names and telephone numbers is to be provided upon request.

I. All prospective Bidders shall use licensed electricians for any electrical work being performed within this contract.

1.04 CONTRACT SUPERVISION

A. The Electrical Contractor will assign a competent full-time superintendent to the project, and that superintendent shall be maintained on the project for its duration.

1.05 GENERAL PROVISIONS

A. All Division 26 installations shall be performed by an electrical contractor who is certified in the product specified. A copy of certification documents must be submitted with the bid for such bid to be valid. The Electrical Contractor is responsible for workmanship and installation practices in accordance with the wiring program specified. At least 30 percent of the copper installation and termination crew must be certified by the manufacturer specified. In addition, at least 10 percent of the optical fiber installation and termination crew must have technician level of training and must be certified by the manufacturer specified or other approved organizations in Optical Fiber installation and termination practices.

B. All electrical installations shall be performed by a electrical contractor possessing a New York State Electrical license.

C. Any specifications that apply to the electrical contractor will be referred to Division 26 specification.

D. Where the word "Provide" is used, it shall be defined as requiring the furnishing and installing of all items indicated complete in all respects and ready for operation unless otherwise specifically noted.

E. The Electrical Contractor shall be responsible for furnishing all labor, superintendence, materials, tools, equipment, and sources necessary for the complete installation of all data work for this technology implementation project as shown on the plans and as herein specified.

F. The Clerk of the works or Construction Manager will be assigned to the project by the Owner and will be clearly defined to the contractor before any work commences.

G. It is the intent of this specification and the accompanying plans that the Electrical Contractor provides a data cabling system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation whether or not such items or accessories are shown on the plans or mentioned in these specifications shall be furnished and installed.

H. Where the words inactive components is used it refers to all network materials such as patch panels, jacks, patch cords, etc. that are passive to the network (Infrastructure).

I. The Electrical Contractor shall, in writing, accompanying his/her bid, report to the Architect/Engineer of any discrepancy or existing condition which would prohibit him/her from performing his/her work to its full extent - a complete and acceptable system.

J. No "Waiver of Responsibility" for inadequate, incomplete, or defective work will be considered or accepted by the Architect/Engineer unless written notice of a difficulty arising from any existing condition is made part of this Contractor's bid.

K. At each location that a new voice/data or audio/video cable is provided two (2) patch cords shall be provided. One (1) for the closet side and one (1) for the device side. Patch cord lengths and colors shall be coordinated and finalized with the Owner.

1.06 GENERAL SPECIFICATIONS

A. The following Drawings and accompanying specifications are for the sole purpose of providing the Owner with a complete and thorough infrastructure solution.

B. All inactive components such as the cabling, jacks, racks and such are part of this contract and are the responsibility of the Electrical Contractor to supply and install according to industry standards and accompanying specifications.

C. Workstations and any software running within the workstations are outside of this scope and thus not part of this contract.

D. It is the intent of this specification and accompanying drawings to show an overall network infrastructure design but not a complete detail of all components within the design. It is the responsibility of the Electrical Contractor to provide, install and configure all materials and components in order to have a complete and thorough data network infrastructure system.

E. The Electrical Contractor will provide the specified manufacturer solution for the CAT-6/6A copper cabling in order to provide the Owner with an extended warranty. Alternate manufacturer solutions will be accepted at the discretion of the owner/engineer.

F. The Electrical Contractor will provide the specified manufacturer solution for the fiber cabling in order to provide the Owner with an extended warranty. Alternate manufacturer solutions will be accepted at the discretion of the owner/engineer.

G. Wherever a discrepancy occurs in the specifications or the drawings or between the drawings and the specifications the contractor will accept the architect/engineer’s interpretation of such issue(s).

H. Neither the drawings nor the specifications shall take precedence over the other. Where conflict occurs between both, the one with the more stringent standards shall supersede the other.

1.07 MATERIALS

A. All materials, active or inactive, mentioned for this project are described by specific brand names. It is the intent of the architect/engineer to set a performance standard based on the specific brand name mentioned. The contractor may submit any other brand name just as long as the equipment or materials meet the performance standards as that of the specific brand that the architect/engineer has chosen.

B. It is the responsibility of the contractor to provide, install and configure all materials or equipment mentioned or not mentioned throughout this package in order to achieve a complete and thorough structured cabling system as described previously.

C. The cabling system described in this specification is derived from the recommendations made in recognized telecommunications industry standards.

The following documents are incorporated by reference:

1. ANSI/TIA 568.0-D, Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA 568.1-D, Commercial Building Telecommunications Cabling Standard
3. ANSI/TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard
4. ANSI/TIA-568C.3 Optical Fiber Cabling Components Standard
5. ANSI/TIA-568C.4 Coaxial cabling Components Standard
6. ANSI/TIA 606B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
7. ANSI/TIA 607-C, Commercial Building Grounding/Bounding Re ANSI/TIA 942-A Telecommunications Infrastructure Standard For Data Centers
8. TIA-862-A, Building Automation Systems Cabling Standard
9. ANSI/TIA 569-D, Commercial Building Standard for Telecommunications Pathways and Spaces
10. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – 13th Edition.
11. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) -2017 Edition

D. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Electrical Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

E. This document does not replace any code, either partially or as a whole. The Electrical Contractor must be aware of local codes that may impact this project.

F. It is the responsibility of the Electrical Contractor to notify the architect in writing if there are any conflicts with the materials or products the architect/engineer has specified that will make a complete network system installation impossible or difficult.

1.08 ALTERNATES

A. Although the Owner does not restrict, by use of a brand name or model, it does have certain features, which it deems desirable. The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

B. Bidders wishing to submit alternate equipment shall submit to the Architect/Engineer the system proposed to provide an equivalent functional alternate to meet specifications. Bidders shall provide all pertinent information including manufacturer specification sheets, working drawings, shop drawings and a demonstration of the system.

C. Contractors bidding equipment or systems other than those items specified shall submit those items as equivalents or substitutions to those specified on the Bid Proposal Form in the applicable location. Complete specifications and literature describing alternates MUST be attached to the Bid Form on each item bid. Contractors bidding on substituted or equivalent items may be required to provide a sample of same for evaluation.

D. No substitutions will be considered after the Contract award.

1.09 CODES

A. All work included within the specification package and in the drawings shall be governed by the following rules, guidelines, standards, and authorities. All documents listed are believed to be the most current:

NEC	National Electric Code 2017 Edition
OSHA	Occupational Safety & Health Administration
ANSI	American National Standards Institute
NFPA	National Fire Protection Association
ASA	American Standards Association
IEEE	Institute of Electrical & Electronics Engineers
NEMA	National Electronics Manufacturers Association
UL	Underwriters' Laboratory
ELT	Electrical Testing Laboratories Inc.
EIA	Electrical Industries Association
TIA	Telecommunications Industries Association
FCC	Federal Communications Commission
ISO	International Standards Organization
BICSI	Building Industry Consulting Service International

B. All equipment or material that is subjected to UL listings shall be properly labeled.

PART 2 – SCOPE OF WORK

2.01 INSTALLATION CHECKLIST

A. The Electrical Contractor shall have the following information in order to install a complete and accurate job:

- The Drawing Set
- The Design Documentation Project Manual.

2.02 WORK INCLUDED

A. All work required to install and configure a complete data network infrastructure system as described previously will be the Electrical Contractors' responsibility. The work included under this specification consists of furnishing all labor, equipment, materials/supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance

with the specifications and drawings. The Electrical Contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install a complete telecommunication wiring infrastructure as specified later in this specification package according to industry standards.
2. Furnish, install, and terminate all UTP cable.
3. Furnish and install all wall plates, jacks, patch panels and patch cords.
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Perform link or channel testing (100% of horizontal and/or backbone links/channels) and certification of all components.
7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Adhere and comply with all requirements of specified programs.

C. The Electrical Contractor will provide and install all cabling at the teacher drop locations where applicable. This includes all video and audio jumpers and video and audio patch cables.

D. The Electrical Contractor will terminate all data cabling as specified later in this specification package according to industry standard in specified surface raceway provided and installed by the Division 26 electrical contractor.

E. The Electrical Contractor shall coordinate with the electrical contractor all data drop location setup components as mentioned in specification Section 271501 and drawings.

F. The Electrical Contractor will provide and install all specified materials at all specified wire closet locations.

G. The Electrical Contractor will be responsible for any damage done to any part of the buildings during the installation of the network wiring.

H. All building penetrations used for the network wiring infrastructure shall be the responsibility of the Electrical Contractor. This includes core drilling and access to any rooms.

I. The electrical contractor will be responsible for the removal and relocation of any smart boards, tack boards, tack strips, etc.

J. The electrical contractor will be responsible for any cutting and trimming that may be required to install specified surface raceway in all data drop locations. The contractor shall be responsible for all patching and painting to restore to original condition.

K. The Electrical Contractor will provide all testing results for the specified equipment and products.

L. The Electrical Contractor will follow all industry standards for the installation of all materials and equipment.

2.03 GUARANTEE/WARRANTY

A. The Electrical Contractor will be able to provide two separate extended warranties for the data cabling being installed, one for the CAT-6/6A copper cable installation and one for the Fiber Optic cable installation.

B. The extended warranty must be backed by the manufacturer and shall be no less than 20 years.

C. If the Electrical Contractor is submitting alternate materials or equipment, the substituted material or equipment shall provide the extended warranty that is required of the system.

D. Any failed network equipment or material shall be the responsibility of the Electrical Contractor and shall be replaced immediately.

E. Besides the extended manufacturer warranty, the Electrical Contractor will provide the Owner with a separate warranty notifying the Owner that all work performed by this contractor or any of his/her subcontractors or anyone the contractor employed for any installation of the network infrastructure for the Owner was done according to the specifications of the project and in accordance with all applicable industry standards. This warranty will guarantee all work against faulty and improper material and workmanship. This warranty shall be no less than 1 year and any other warranties for longer terms that apply to any of the components or materials shall apply.

F. The Electrical Contractor will provide the extended manufacturer's warranty and his/her own personal warranty no longer than 15 days after he/she has stated in writing and the architect or engineer have verified that the full network installation and configuration has been finished and completed.

2.04 WORK SCHEDULING

A. The Electrical Contractor must submit, in writing to the Owner, a schedule of the work that will be performed throughout the project by building. The work schedule shall be submitted for approval to the clerk of the works or construction manager no later than 7 days after the award has been issued.

B. The Electrical Contractor must adjust his/her work schedule and working hours according to the Owner's schedule. It is the responsibility of the contractor to coordinate his/her schedule with that of the Owner.

C. The Electrical Contractor's work will not be allowed to interfere with the Owners daily work schedule unless given direct permission from the clerk of the works or construction manager.

D. The Electrical Contractor will be responsible for cleaning up any debris caused during the installation after each work period (daily).

E. No data cables shall be left exposed at the end of each work period and any equipment specified for the network design shall not be left accessible to the public. The Electrical Contractor must secure all data wiring and network components at the end of the work period.

F. The clerk of the works or construction manager shall perform a visual inspection at the end of the workday in order to determine that the Electrical Contractor is following proper procedures for securing and cleaning the work area.

G. Any drilling that must be performed must first be cleared with the clerk of the works or construction manager or architect/engineer.

H. Any relocation or removal of any existing equipment such as tables, shelves, file cabinets etc., shall first be cleared with the clerk of the works or construction manager for approval.

I. The Electrical Contractor will replace any ceiling tiles removed during the workday as to not have any exposed wires during the next Owner workday.

J. No surface raceway shall be left exposed with data or electrical cables installed.

K. If the Electrical Contractor must integrate any existing LAN(S) into the new LAN, the contractor has to notify the Owner or the clerk of the works or construction manager of any interruption that might occur during the process. The clerk of the works or construction manager will ensure that all parties are notified, which may be affected by the down time on the existing network in order to achieve a full installation and integration to the new LAN.

L. The Electrical Contractor must notify the clerk of the works or construction manager and architect/engineer of any conditions that might cause a delay in the completion of the project.

M. The Electrical Contractor must coordinate with the clerk of the works or construction manager for a storage location(s).

N. The Owner will not provide a location where the contractor can store his/her equipment. The Electrical Contractor shall provide his/her own storage facilities.

O. The Electrical Contractor will have to coordinate his/her schedule with that of the electrical contractor since the electrical contractor will be providing and installing the surface raceway at the data drop locations.

2.05 SUBMITTALS

A. With the bid response the Electrical Contractor will submit a list of all the subcontractors that will be involved with the project.

B. With the bid response the Electrical Contractor will submit all cut sheets for all materials and equipment being proposed for installation. This list will be subject to review and approval by the architect.

C. All equipment or material in a material list shall first be approved before any shop drawings can be submitted by the contractor.

D. Before any data cables are pulled, the Electrical Contractor must submit a printed schedule of all data drop locations. The schedule shall indicate the data drop identification and termination location. The engineer or architect must review and approve the pull schedule prior to startup of any work.

E. Shop drawings shall be submitted with sufficient time for the engineer or architect to review drawings.

F. Shop drawings and cut sheets must be submitted for all equipment or material being used for project completion. The cut sheets shall be original catalog or PDF reproduced sheets clearly identifying the item submitted.

2.06 DRAWINGS

A. It shall be understood that the details and drawings provided with the specifications are diagrammatic. They are included to show the intent of the specifications and to aid the Electrical Contractor in bidding the job. This contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The Electrical Contractor shall verify all dimensions and distances at the site and be responsible for their accuracy.

C. Prior to submitting the bid, the Electrical Contractor shall call the attention of the engineer or architect any materials or apparatus the contractor believes to be inadequate and to any necessary items of work omitted.

PART 3 – MATERIAL SPECIFICATIONS

3.01 COPPER NETWORK CABLING

A. Horizontal cabling, cable to the workstation, shall be Category 6/6A Unshielded Twisted Pair, 4 pair, as manufactured by Hitachi Cable of America or equal.

B. Cable must be plenum rated with UL, CMP listing.

C. Cable must be 4 pair 23 AWG Solid UTP, FEP primary insulation and a low smoke PVC jacket.

D. The copper cable must be able to handle the following applications:

- Gigabit Ethernet/1000 Base-T
- Fast Ethernet/100 Base-T
- Ethernet/10 Base-T
- 155 Mbps ATM
- IEEE 802.3
- IEEE 802.3ab
- IEEE 802.5
- IEEE 802.12
- ISDN
- Voice
- 550MHZ Broadband Video

E. The Category 6 cable shall meet or exceed ANSI/TIA Category 6 requirements for NEXT, Characteristic Impedance, SRL, Attenuation and Delay Skew, PS-NEXT, ELFEXT and PS_ELFEXT.

F. All UTP drops must be certified at 20 degrees C with a length not to exceed 90 meters.

G. All UTP drops must perform within the following parameters at 250 MHz:

Electrical Parameters (@ 250MHz)	**TIA 568-C.2 verified min. std. (Additional performance margin guaranteed)**
Insertion Loss	32.8 dB
NEXT	38.3 dB (41.3 dB)
PSNEXT	36.3 dB (39.3 dB)
ACRN	5.5 dB
PSACRN	3.5 dB
ACRF	19.8 dB (22.8 dB)
PSACRF	16.8 dB (19.8 dB)
Return Loss	17.3 dB

1. Termination of the copper cable shall be at an 8-position snap-in modular jack following the T568B pin assignment. All audio/video over CAT 6 cable components shall be terminated using the color code on the back of the modules. The maximum allowable amount of untwisting during cable termination shall be less the ½ inch.

2. As an option, Category 6A cabling shall be considered. This cabling shall meet all of the specifications listed above. In addition to the above, it must support 10G base T;

Electrical Parameters (@ 500 MHz)	**TIA 568-C.2 verified min. std. (Additional performance margin guaranteed)**
Insertion Loss	45.3 dB
NEXT	33.8 dB
PSNEXT	31.8 dB
ACRF	13.8 dB
PSACRF	10.8 dB
Return Loss	15.2 dB
PSANEXT	52.0 dB (58.0 dB)
PSAACRF	24.2 dB (30.2 dB)

3.02 MULTI-MODE FIBER OPTIC CABLE-

A. The backbone cable between the zone cabling box and the existing ER shall be Armored 12 strand 50/125 multimode cable OM3 or OM4 LOMM Fiber

B. All fiber optic strands shall be terminated at both ends with LC Connectors. These Optical Fiber cables shall be either Quick Crimp Connectors or Pig tails that are to be fusion spliced, as specified.

C. Certified installers for such equipment shall perform all terminations.

D. Minimum bend radius allowed of the cable shall not exceed 12 times the outside diameter of the cable which is approximately 2 inches.

E. Connectors shall have a maximum of 0.5dB loss per connection and be industry standard type designed for LOMM 50-micron fiber.

F. Provide fiber optic patch cords to connect all pairs from fiber patch panel to voice and data switches. Cables shall be LC to LC, 1, 2 and 3 meters for each closet.

3.03 MAIN WIRE CLOSET EQUIPMENT ROOM (ER)/REMOTE WIRE CLOSET TELECOMMUNICATIONS ROOM (TR) MATERIALS

A. These materials shall include but not limited to vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack.

B. Ladder Rack and Waterfall cable management shall be provided at the top of the rack for all network cable and fiber entering the rack for protection and to maintain proper bend radius and cable support.

C. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack.

D. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack.

E. Racks shall have EIA hole pattern on front and rear.

F. Rack shall be black in color to match the patch panels and cable management.

3.04 DATA DROP LOCATION AND MATERIAL

A. Refer to Technology Series Drawings for a list of all materials at all data drop locations.

B. All data drop network cable shall be neatly dressed, secured and concealed throughout the installation.

C. The Electrical Contractor shall install the Data Drop network cables with a maximum of 1-meter service loop (slack cable) neatly coiled and secured in ceiling space above at the station location and a 2-meter service loop at the closet end.

PART 4 – DETAIL SPECIFICATION

4.01 CABLE ROUTING AND INSTALLATION

A. The following guidelines apply to all technology cabling being installed and routed through the hallways, classrooms or any other location where the specified cable will be installed.

B. It is the responsibility of the Electrical Contractor to determine the best possible path for any cable run as long as it follows the network design set forth by the architect/engineer.

C. Wherever possible the Electrical Contractor will route all his/her cable in the cavity created by the drop ceiling, crawl spaces or attic space. All cables shall be plenum rated.

D. Wherever the Electrical Contractor is unable to route cables as mentioned in item C, the contractor shall run cables in architect/engineer approved surface raceway or conduit at a maximum fill capacity of 40%. For any penetrations of conduit or raceway through fire rated partitions, please refer to Section 078413 – Penetration Firestopping, for fire stopping requirements.

E. All cabling shall be supported in cable support system such as “J” hooks or any other approved support system. Data cables shall be bundled with plenum rated hook and loop Velcro ties to a snug fit, which does not deform the cable geometry.

F. All network cables shall be secured a minimum of six (6) inches above the ceiling T-bar grid.

G. The Electrical Contractor should maintain TIA/EIA standards which deal with the proximity of communications cabling to high voltage cabling, motors, transformers, fluorescent lighting and ballast’s, etc. If these standards can’t be met the contractor shall notify the architect/engineer. In addition to the installation standards from BICSI,

H. The Electrical Contractor shall not rest, fasten, or support the data cables on; steam pipes, electrical conduit, insulated pipes or sprinkler pipes, ceiling grid supports, water pipes or HVAC ducting.

I. In areas without adequate support structures, the Electrical Contractor shall install “J” hooks or additional ceiling grid hangers on five (5) foot off center secured to a building structure.

J. Strip ties, saddles and J-hooks shall be plenum rated and must be installed as per industry standards.

K. The Electrical Contractor shall not install more than 15 individual data cables to a single hanger or “J” hook without the use of a two-inch wide saddle to eliminate strain on the individual cables.

L. The Electrical Contractor shall be responsible for replacing or patching any system that was damaged during network installation.

M. The Electrical Contractor will not support any data cables with power cables or fire alarm cables within the same support system.

N. The Electrical Contractor must avoid installing all cable in any location that may cause any obstruction to any existing building functions.

O. If Electrical Contractor chooses to run cables in attic space, he/she must lay cables in J-Hooks or cable trays.

4.02 WALL OR FLOOR PENETRATIONS

A. The Electrical Contractor must notify the clerk of the works or construction manager of any drilling that may be required to install data cables.

B. The Electrical Contractor is responsible for drilling that is not performed by the General Contractor in all locations needed to install specified data wiring.

C. The Electrical Contractor must provide and install all sleeves and conduits that may be necessary for a proper installation of their specified data wire.

D. If necessary, the Electrical Contractor must provide his/her own separate wall or floor penetrations for data wiring. The contractor may not use existing penetrations because existing penetrations may not be sleeved, and damage may be caused to existing wires at that location.

E. If conduit is being used the size of conduit must be determined by the number of cables that will be installed within conduit. Conduit fill shall not exceed 40 percent.

F. Conduit shall be installed with the appropriate bend radii to maintain the required bend radius for the Copper and Fiber Optic Cable. Install pull boxes every 100 feet and at every 90-degree turn.

G. It is the responsibility of the contractor to provide fire stopping at all penetrations made by him/her in all fire-rated and time rated walls, floors, ceilings, and partition assemblies in accordance with National Electric Code.

H. The Electrical Contractor shall provide the Owner with a fire stopping system, installed to resist the spread of fire and the passage of smoke and other gases.

I. The fire stopping material shall be approved and tested by U.L. or other qualified and approved inspection agency for the designated fire resistance rating.

J. The fire stopping material shall contain no detectable asbestos and comply with all local regulations.

4.03 TELECOMMUNICATIONS ROOM (TR) INSTALLATION

A. Refer to Technology Drawings for a list of materials at all wire closet locations.

B. Wall mounted termination shall be mounted on 4’ x 8’ x .75” void free, fire-resistant plywood. The plywood shall be mounted vertically 12” above the finished floor. The plywood shall be painted with two coats of white fire-retardant paint.

C. The network cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B standard and best industry practices.

D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

E. Cables shall be neatly bundled and dressed to their respective panels. Each panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

F. All cables shall be routed through a cable support system, ladder rack and waterfall cable management shall be provided at the top of the rack for all network cable and fiber entering the rack for protection and to maintain proper bend radius and cable support.

G. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

H. Racks shall have EIA hole pattern on front and rear.

I. The Electrical Contractor must provide 20 percent spare ports in Category 6/6A and Fiber patch panels for future use.

J. Any cables leaving or entering the wire rack shall be neatly bundled and encased in approved cable management system.

4.04 DATA DROP LOCATION INSTALLATION

A. The Division 26 Electrical Contractor will provide and install all raceway, divider, power, receptacles, and faceplates within the Data Drop Location except for the Category 6 Modular Jacks (refer to E/T series drawings).

B. All materials that will be mentioned in this section have been identified and specified earlier in this specification package under Part III.

C. Refer to Technology Drawings for a complete list of materials at all data drop locations.

D. The Division 26 Electrical contractor will install dual surface raceway in specified locations. Electrical contractor will provide and install divider wall within surface raceway. Divider wall must run continuously throughout surface raceway.

E. All surface raceways shall be mechanically anchored with appropriate fasteners.

F. Electrical contractor must terminate metal jacket of power cable/conduit properly at entrance of surface raceway.

G. All data drops shall be spaced 3’ on center. The Electrical Contractor shall notify the clerk of the works or construction manager if this setup is not possible and then contractor shall space out data drops evenly about the length of surface raceway that can be installed.

H. The Electrical Contractor will install CAT-6/6A copper cable within surface raceway and terminate it in front loading Enhanced CAT-6 modular jacks following T568B standards. Modular jacks shall be installed in snap in faceplates which will be installed in specified molded covers.

I. The Division 26 Electrical contractor is responsible for all branch circuits, receptacles and hanging device brackets if specified (refer to E/T series drawings).

J. Electrical contractor will supply and install all accessories as required for a complete installation of surface raceway (refer to E/T series drawings).

K. Cable shall be labeled at each end.

L. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

M. The Electrical Contractor shall coordinate with the architect/engineer any surface raceway configuration changes caused by any obstacles and or casework locations.

N. Cutting and notching of any ornamental trimming will be the Division 26 electrical contractor's responsibility. The electrical contractor must notify the clerk of the works or construction manager if any cutting for proper installation must take place.

O. Electrical contractor shall notify the clerk of the works or construction manager if installation of surface raceway is impossible at any specified location.

P. Electrical contractor shall notify the clerk of the works or construction manager if installing a different setup than that which has been specified.

PART 5 – PROJECT CLOSE-OUT

5.01 GENERAL PROVISIONS FOR TESTING

A. Before final application is considered for review the Electrical Contractor must submit all test results to the architect/engineer in order for them to be reviewed and accepted.

B. The clerk of the works or construction manager can be present during such testing and will be able to inspect contractor installation and workmanship.

C. Any work that does not comply with specifications mentioned throughout this specification package or industry standard shall be replaced and reinstalled at contractor's expense.

D. Certificate of compliance and all test results shall be provided to the Owner upon each item of testing.

E. Any failed copper cables or fiber optic cables shall be removed and re-installed. If a fiber strand fails out of the full fiber optic cable bundle, then the contractor will denote that fiber strand and remove it from any termination equipment. Data contractor will then replace that failed # of strands.

F. Electrical Contractor shall submit written test reports for all types of cables and on each individual cable. All individual test reports shall be bound into a booklet form. Electrical Contractor shall submit (1) paper copy of final testing report to Architect/Engineer and all data on CD. For multiple buildings provide (1) copy for each building involved in the project.

G. Prior to the start of work, Electrical Contractor shall submit test booklet format and blank test report forms for Engineer approval.

H. Report booklet shall include final riser diagrams with cable identification numbers.

I. Provide cover sheet per building including all nodes and associated test results. Cover sheet shall include Building Name, Wiring Closet Number, Type of Cable, Room Number, Room Name, Result (Pass or Fail), Length, etc.

5.02 CATEGORY 6/6A COPPER CABLE TESTING

A. Category 6 copper cable shall meet all manufacturing standards and all ANSI/TIA 568C.2 standards for attenuation, Propagation Delay, Delay Skew, NEXT, PSNEXT ELFEXT PSELFEXT and return loss.

B. A field tester meeting the requirements set forth in the 568C.2 standard and use the latest version of the Fluke tester or an equivalent.

C. All cabling testing shall be done at not only all points of connectivity to the network, but also at each cable for any breaks or damage to ensure connectivity and compliance with the network and EIA/TIA standards.

D. The testing certification sheets shall be made part of the required "Close-out" documentation. Testing sheets shall include wire map, resistance, length, capacities, Attenuation, NEXT, Propagation Delay, Delay Skew, Return Loss, PSNEXT.ELFEXT and PSELFEXT for installed cable. Cable results of the pass results must be submitted in an electronic and paper format. It must be the full tests results from the tester in its native format. * Pass is NOT acceptable.

5.03 FIBER OPTIC CABLE TESTING

A. The Electrical Contractor shall test all optical fiber cable before installing it. A visual continuity test shall be enough.

B. The Electrical Contractor shall use LAN test equipment such as Fluke or equivalent for all installed fiber optic cabling. This testing documentation shall be completed per the ANSI/TIA 568C.3 requirements and be made part of the required “Close-out” documentation. The tested cable shall also be certified to support the required protocols for selected network applications.

C. For complete and accurate testing for fiber optic cables the Electrical Contractor shall follow the following guidelines:

- Confirm test jumpers are of the same fiber core size and connector type as the cable system.
- Ensure that optical sources are stabilized and have center wavelengths within +-20 nm of the 850/1300 nm wavelength.
- Test set-up and performance shall be conducted in accordance with ANSI/TIA 568C.3 standards.
- Power meter is calibrated at each of the nominal test wavelengths and traceable to the National Institute of Standards and Technology (NIST)
- Contractor must confirm all system connectors, adapters, and jumpers are properly cleaned prior to the measurement.
- System loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 for single mode fibers.
- Electrical Contractor will be testing for end-to-end attenuation. The attenuation shall not exceed manufacturer’s specifications and verified by ETL to ANSI/TIA 568C.3 specifications.

D. The Electrical Contractor must measure the attenuation of each connected link after each installation.

E. If attenuation level results are not acceptable, the contractor must perform OTDR testing on failed cable in order to find out what causes the loss and where it occurs in the cable. The contractor will

make appropriate adjustments or reinstallation of the cable in order for the cable to pass attenuation level results.

5.04 AS BUILT DRAWINGS

A. The Electrical Contractor must provide the architect/engineer with as built drawings in an electronic format compatible to AUTOCAD. No hand-generated drawings shall be acceptable. A paper set and an electronic set shall be provided to the Owner.

B. The Electrical Contractor may acquire the background drawings from the architect/engineer upon request. Contractor's drawings can only be used for this project and may not be altered to perform any other work at this Owner's site. A Twenty-Five dollar ($25) per drawing fee will be charged for every AutoCAD drawing requested.

C. The Electrical Contractor must fill out data information charts and turn them over to the Owner. Information charts must be reproduced in written format as well as electronic format.

5.05 SYSTEM WARRANTY, GUARANTEES, AND MANUALS

A. The Electrical Contractor will provide all system and product guarantees as mentioned in section 2.03 to the Owner no later than 10 days after the contractor has submitted in writing of project completion.

B. The Electrical Contractor will provide the Owner all manufacturer manuals for all the installed equipment. Manuals should be clearly labeled and must be provided in some sort of binder or folder for storage purposes.

END OF SECTION

DIVISION 27 – COMMUNICATIONS

SECTION 272000 – DATA COMMUNICATIONS NETWORK EQUIPMENT

PART 1 – GENERAL

1.01 GENERAL NOTES

A. The intent of the specification section is to outline the scope of work that the network contractor shall complete as part of their bid and subsequent required design, implementation, service, and installation.

B. All work associated with this contract and its intent shall be coordinated with all other work as furnished and installed by other trades that may or may not interface, interact, or be dependent upon the work herein.

C. The network contractor shall meet all required deadlines for installation and implementation and shall notify the design engineer of any difficulty that he or she faces that may alter these deadlines.

D. The network contractor shall also notify the engineer or the Owner representative of any design discrepancy, site limitation, or configuration which would prohibit the network contractor from a successful and timely installation. Failure to notify these parties shall result in the network contractor's sole responsibility for it.

E. The network contractor shall be solely responsible for ascertaining, determining, and subsequently paying the appropriate prevailing wage rates for the work herein. The design engineer and the Owner will be held harmless from these and any decisions that the network contractor reaches that pertain to the network contractor's work.

1.02 PROJECT DESCRIPTION

A. The following specifications are for the installation of network equipment and services.

1.03 BIDDERS QUALIFICATIONS

A. All prospective bidders must be certified installers for all equipment listed.

B. All prospective bidders must possess a minimum of five (5) years continuous experience as a firm doing business under the same name, engaged principally as a network contractor for the work proposed.

C. All prospective bidders must maintain an experienced technical and in house organization for the project and must maintain an office facility with full-time employees in a commercial space.

D. All prospective bidders shall be able to provide the Owner with the appropriate manufacturer’s warranty and service on the proposed equipment.

E. All prospective Bidders will maintain a staff of trained, certified technicians for equipment being specified for said job.

F. A list of projects completed within the last year with contact names and telephone numbers is to be provided.

1.04 CONTRACT SUPERVISION

A. The Electrical Contractor will assign a competent project manager that will be responsible for the project.

B. The Owner reserves the right to request a change of project managers if the original project manager does not perform to Owner's standards.

1.05 GENERAL PROVISIONS

A. All network installations and configurations shall be performed by a network contractor who is certified in this field. This network contractor shall be referred to as the "Network contractor" for the remainder of this specification.

B. Where the word "Provide, is used, it shall be defined as requiring the furnishing and installing of all items indicated, complete in all respects and ready for operation unless otherwise specifically noted.

C. The network contractor shall be responsible for furnishing all labor, superintendence, materials, tools, equipment, and sources necessary for the complete installation of all work for the technology implementation as shown on the plans and as herein specified.

D. It is the intent of these specification and the accompanying plans that the network contractor provides a system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation whether or not each such item or accessory is shown on the plans or mentioned in these specifications shall be furnished and installed.

E. Where the word active components is used it refers to all network equipment such as switches, routers, and modems that process data traffic.

1.06 VERIFYING EXISTING CONDITIONS

A. The network contractor shall, prior to submitting his/her bid, examine all the existing site (s) /building (s), etc. that are in any way dependent upon the work herein.

B. The network contractor shall, in writing, accompanying his/her bid, report to the engineer of any discrepancy or existing condition which would prohibit him/her from performing his/her work to its full extent - a complete and acceptable project.

C. No "Waiver of Responsibility" for inadequate, incomplete, or defective work will be considered or accepted by the Engineer unless written notice of a difficulty arising from any existing condition is made part of this network contractor's bid.

1.07 GENERAL SPECIFICATIONS

A. The following specifications are for the sole purpose of providing the Owner with a complete and thorough Local Area Network with Internet connectivity.

B. All active components such as switches and routers are part of this contract and thus the network contractor will install and configure such equipment.

C. All inactive components such as the cabling, jacks, racks, surface raceway and such are part of this contract and thus is the responsibility of the Division contractor to supply and install such.

D. Workstations and any software running within the workstations are outside of this scope and thus not part of this contract.

E. Wherever a discrepancy occurs in the specifications or the drawings or between the drawings and the specifications the network contractor will accept the engineer's interpretation of such issue(s).

1.08 MATERIALS

A. The Network Contractor will supply a list of materials for the Owner. The list of equipment that shall be provided and configured, must be defined by the Owner, along with closet location.

B. All active component material should include ten percent additional ports for closet's up to 100 drops, five percent for closets 101 to 300 drops, and 2.5 percent for closets over 301 drops.

C. It is the responsibility of the network contractor to provide, install and configure all materials or equipment mentioned or not mentioned throughout this package in order to achieve a complete and thorough network solution as described previously.

D. It is the responsibility of the network contractor to notify the engineer in writing if there are any conflicts with the materials or products the engineer has specified that will make a complete network system installation impossible or difficult.

PART 2 – SCOPE OF WORK

2.01 INSTALLATION CHECKLIST

A. The Network contractor shall have the following information in order to install a complete and accurate job:

- The Design Documentation Project Manual.

2.02 WORK INCLUDED

A. The network contractor shall provide and install all specified equipment. Installation of such equipment includes the racking and stacking of all switches and routers.

B. The network contractor must configure all specified equipment.

C. Owner requirements such as VLANS, IP Addressing, Security etc. shall be discussed and documented with the network contractor prior to the submittal.

D. It is the responsibility of the network contractor to obtain the most recent patches, builds, drivers and upgrades, for all active networking components. These devices will be upgraded, flashed, and configure to the most recent set of available standards prior to turning the system over for Owner use.

E. The network contractor must supply network management software, which will recognize all new equipment, and existing Owner equipment.

F. Network contractor will be responsible for providing and installing all specified patch cables at the wire closet.

2.03 GUARANTEE/WARRANTY

A. The network contractor will be able to provide manufacturer's warranty to the Owner.

B. Any failed equipment of material shall be the responsibility of the network contractor and shall be replaced immediately.

2.04 WORK SCHEDULING

A. The network contractor must submit, in writing to the Owner, a schedule of the work that will be performed, and indexed by building.

B. The network contractor must adjust his/her work schedule and working hours according to the Owners schedule. It is the responsibility of the network contractor to coordinate his schedule with that of the Owner.

C. The network contractor's work will not be allowed to interfere with the Owner's daily work schedule unless given direct permission from the organization.

D. The network contractor will be responsible for cleaning up any debris caused during the installation after each work period (daily).

E. The network contractor must secure all network active components at the end of the work period.

F. The Owner assigned personnel shall perform a visual inspection at the end of the workday in order to determine that the network contractor is following proper procedures.

G. Network Contractor must notify the Owner if they will be removing any existing network equipment.

H. The network contractor must notify Owner assigned personnel of any conditions that might cause a delay in the completion of the project.

I. The network contractor must coordinate with Owner assigned personnel for a storage location(s)at the site.

PART 3 – MATERIALS

3.01 ACTIVE COMPONENTS

A. The equipment list of all materials, such as switches, router, and associated materials, will be supplied to the Owner for approval.

3.02 PATCH CABLES

A. Network contractor must provide all Category 6 patch cables at all wire closets.

PART 4 – DETAIL SPECIFICATION

Not Applicable

PART 5 – PROJECT CLOSE-OUT

5.01 GENERAL PROVISIONS FOR TESTING

A. Before final application is considered for review the network contractor must submit all test results to the Owner in order for them to be reviewed and accepted.

B. The Owner assigned personnel can be present during such testing and will be able to inspect network contractor installation and workmanship.

C. Any work that does not comply with specifications mentioned throughout this specification package or industry standard shall be replaced and reinstalled at network contractor's expense.

5.02 SYSTEM WARRANTY, GUARANTEES AND MANUALS

A. Data network contractor will provide all system and product guarantees as mentioned to the Owner no later than 10 days after network contractor has submitted in writing of project completion.

B. Network contractor must notify the Owner of how guarantees and warrantees should be handled, and network contractor must fill out all the warranty cards for all the active components for the Owner.

C. Network contractor will provide the Owner all manufacturer manuals for all the installed equipment. Manuals should be clearly labeled and must be provided in some sort of binder or folder for storage purposes.

D. All documentation, software, license agreements, etc. shall be turned over to the Owner upon completion of the project.

END OF SECTION

DIVISION 27 – COMMUNICATIONS

SECTION 274116 – AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

I. Various AV Systems

a. GENERAL REQUIREMENTS

i. The work specified in this Section shall be in accordance with the requirements of the Contract Documents.

b. SUMMARY

i. Audiovisual system specification includes systems located at the Bedford School District It is the intent of this specification system to provide a full turn-key audio system with cabling, conduit, mounting, and testing as required

ii. Types of work in this section include (but are not necessarily limited to):

1. Sound reinforcement equipment.
2. Racks and consoles.
3. Portable and accessory equipment.
4. Verification of dimensions and conditions at the job site.
5. Submission of shop drawings for review prior to fabrication.
6. Fabrication and assembly shall be in accordance with these specifications: Equipment manufacturer recommendations, all applicable code requirements.
7. Inspection, alignment, final adjustment of completed installation, demonstration for acceptance and instruction of operating personnel.
8. Coordination with other trades of adjoining work.

c. DEFINITION OF TERMS

i. The term Contractor or Audiovisual Contractor as used herein refers to the party responsible for supplying all services and equipment covered herein and on related electrical drawings.

ii. The terms Owner, Consultant is used herein to refer to organizations, individuals and their representatives as typically defined.

d. INDUSTRY STANDARDS

i. Regulatory Agencies: Work shall be carried out in conformance with applicable Building and Electrical Codes, the requirements of OSHA and the applicable provisions of Underwriter's Laboratories, ANSI, Electronic Industries Association and National Fire Protection Association.

e. QUALITY ASSURANCE

i. The system shall be comprised of components that are of professional quality. Approved manufacturers shall be as specified herein.

ii. This Contractor shall be an authorized direct representative of the manufacturer of the specified loudspeakers, preamplifiers and amplifiers selected by the Consultant.

iii. The Contractor shall have all required manufacturer's certificates where required (i.e. Digital Media Certified Engineering DMC-E and Design DMC-D)

iv. The Contractor shall have on staff, individuals that have received ANSI Certification through the ISO/IEC 17024 General Requirements as a "Certified Technical Specialist"

v. The Contractor shall have on staff, individuals that have been trained on OSHA Safety regulations receiving OSHA-30 Certification

vi. This Contractor shall have successfully provided installation and engineering services over completed installations for a period of five years or more and shall

have completed at least five major sound system installations of this type. The Owner and Consultant shall be the final judge of suitability of experience.

f. SUBMITTALS
   i. Shop Drawings and Samples:
   ii. The following scaled drawings shall be provided for review prior to fabrication:
      1. Equipment rack layouts showing equipment layout, rack accessories and modifications (min. 1.5"=1'-0" scale).
      2. Installation details (min. 1"= 1'-0" scale).
      3. Block schematics of all system equipment, internal wiring and system element interconnection (as necessary). Include pictorial of all patching panels and include proposed patch point legend.
      4. Major dimensions components and finishes of all equipment and accessories.
      5. Catalog or data sheets shall be used where applicable.
      6. Suspension arrangement for the loudspeakers. This drawing shall indicate hanging details and orientation of loudspeakers as required for proper coverage as specified. Shop drawings shall be sealed by a structural engineer licensed in the State of New York.
      7. All shop drawings shall be executed on CAD and in conformity with the best modern practice.
      8. A 3" x 5" space shall be reserved in the lower right comer of each drawing for the Consultant's review stamp.
      9. Drawings used in the fabrication and installation of the systems specified herein shall bear the Consultant's stamp.
      10. Review of shop drawings shall not be considered as a guarantee of measurements of building conditions. Where drawings are indicated as having been reviewed, said review does not mean that drawings have been checked in detail, and said review does not in any way relieve this Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Specifications.
   iii. Manuals:
      1. Within thirty days of the Acceptance Tests, this Contractor shall furnish the following:
         a. Four copies of block diagram of the system giving the essentials of the installation and their functional relations. Another copy of the diagram(s) shall be wall-mounted behind glass at the equipment rack location.
         b. Four copies of a complete instruction, operation and maintenance book, including all block and schematic diagrams, wiring diagrams, sizes, and manufacturer technical descriptions of components.

g. DELIVERY, STORAGE AND HANDLING
   i. The equipment to be furnished hereunder shall be delivered to the building upon receipt of written notice from the Owner to do. Delivering hereunder shall include unloading the vehicle, transportation to final destination within the building.
   ii. Fabricated and assembled equipment shall be wrapped and sealed in polyethylene and substantially boxed for shipment. Standard components shall be shipped in

manufacturer's original packing. Boxes shall clearly indicate equipment contained, "front", "top", "fragile", nature of components and site location.

iii. Liaison shall be made between this Contractor and the Owner for the delivery schedules of components being shipped. The requirements for safe handling and storage of these components shall be coordinated between these two parties.

iv. The Contractor shall be solely responsible for the security of equipment at the project site until final acceptance by the Owner and Consultant.

h. ALTERNATES

i. Alternate Equipment:

1. Alternate equipment is that which has been determined to have substantially similar characteristics to that specified and has been judged suitable for use in the system.
2. Where alternate equipment is used changes or modifications to contingent work and equipment may be required to maintain the integrity of the system. This Contractor shall be responsible for maintaining the overall performance of the system when alternates are employed.

ii. Substitutions:

1. Substitute equipment is that which may or may not have been reviewed for inclusion in the system design, or which may have become available following issuance of the Contract Documents.
2. Whenever any product is specified by brand name, manufacturer's or supplier's name or trade name and catalog or model number or name, the intent is not to limit competition but to establish the standard of quality and functional performance of the system and its components.
3. Substitution requests shall be made during submittals. This Contractor shall have the burden of proving at his own cost and expense to the satisfaction of the Consultant that the proposed product is equal to the named product. The Consultant has the right to establish criteria for a product approval. Criteria may include laboratory test data as provided by an independent accredited laboratory approved by the Consultant. If no such testing has been carried out, this Contractor shall instigate such testing at his own cost. In addition, the Consultant will inspect and test any proposed substitution prior to acceptance. This Contractor shall ship, prepaid by UPS (or other carrier as agreeable by the Consultant) the substitution with all shipping costs paid by the Contractor. If the Consultant deems that the item is too large to ship or if, for other reasons, it is deemed that a field inspection is preferred, this Contractor shall pay for the time and reimbursable costs of the Consultant and Owner to conduct the field inspection at the Consultant's and Owner's convenience.
4. If this Contractor fails to comply with the provisions of this Article, or if the Consultant determines that the proposed product is not equal to that named, the Contractor shall supply the product named.
5. This Contractor shall have and make no claim for the extension of time or for damages because the Consultant requires a reasonable period of time to consider a product proposed by this Contractor or because the Consultant disapproves such a product.

6. Where optional materials or methods are specified and/or approved, this Contractor shall make all adjustments to contingent work necessary to accommodate the option he selects.
7. The unit costs of the substitution shall be included with the submittal.

iii. New Products:

1. Minimum performance requirements for individual components specified herein shall be as detailed in the latest published Manufacturers data sheets.
2. In the event that one or more of the products specified herein is unavailable, this Contractor shall make recommendations to the Consultant as to what substitutions are available to meet the intent of the Specification. The Consultant shall then determine what product; either from the Contractors' recommendations, or from the Consultant's own research, may be substituted.
3. The Consultant reserves the right to substitute a new product that may have become available following the issuance of the Contract Documents. Such substitutions shall be made prior to final review of the equipment list.
4. A change order resulting from such substitutions shall not result in an increase or decrease to the Project cost in excess of the difference between the list price of the specified product and the substitute price.

i. GUARANTEE AND SERVICE

i. Contractor shall warrant systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of one year from the date of Owner's acceptance. Paint and exterior finishes and fuses are excluded.

ii. Warranties on manufactured equipment shall be designated to the Owner on the date of system acceptance.

iii. This Contractor shall provide at his expense maintenance service for a period of one year after final acceptance of the installation. The service shall consist of at least two (2) visits to the site for checking and adjusting of equipment.

iv. This Contractor shall be required to answer all service calls within twenty-four hours of a request being made.

v. The Contractor shall provide a price per year for years two through five for a standard preventative maintenance agreement

II. PERFORMANCE REQUIREMENTS

a. SOUND SYSTEM

i. Certain overall performance requirements of the sound amplification system shall be checked by measurement. Each system as designed meets the following requirements based upon available data and the manufacturer's published specifications. The Contractor shall be responsible for use of the equipment specified in the manner specified, and each component's conformance with its manufacturer's specifications.

ii. Overall system frequency response shall be +/-3 dB, 250-8,000 Hz when measured in 1/3 octave bands at any seat. Frequency response shall be measured using Time Delay Spectrometry or 1/3 Octave Real Time Analyzer.

iii. Overall system noise shall be at least 60 dB below +40 dBm (10 watts) output in a frequency range of 20 to 20K Hz measured from the microphone matched input to the speaker terminals.

iv. Residual noise and hum shall be below the masking noise levels produced by the air conditioning system, for an overall signal-to-noise ratio of 68 dB for the entire system.

v. System Electronics Characteristics:

1. Frequency Response: 20-20,000Hz +1-0.5 dB
2. Signal to Noise: Better than -75 dB
3. Distortion: 0.1% THD maximum
4. OPL (Operating Level): +4 dBm

b. SYSTEM EQUIPMENT

i. Microphone System and Accessories:

1. Outputs of all microphones shall be 150-250 ohms, balanced with respect to ground. Microphone mounts and holders shall be supplied by the microphone manufacturer. The term "sensitivity" as used herein for microphones and expressed in dBm (dB referenced to .001 W) is the microphones available electrical input power level, when driven by a sound pressure of 10 dynes/cm2.

ii. Microphone System Installation and Accessories:

1. Cable indicated on the drawings for interconnection between system receptacles equipment shall be provided by the Contractor using existing or new conduit as needed. Contractor shall verify conduit is reusable for new system requirements.
2. Microphone extension cables shall be supplied as specified herein. Each flexible extension cable shall be fitted at one end with a Neutrik NC3MX-B connector, the other end shall be fitted with a Neutrik NC3FX-B connector, Flexible cables shall be Canare L-4E6S.

iii. Rack-Mounted Control and Amplification Equipment:

1. Permanent rack shall be constructed of 12 gauge steel top and bottom and 16 gauge sides. Panel mounting channels shall be provided with holes on E.I.A. spacing. Dimensions shall be 22" wide by 25" deep by the height necessary to accommodate the specified equipment or as shown on the drawings.
2. Unused panel space shall be filled with blank solid panels or ventilating panels. Provide all accessories indicated on the drawings.
3. All racks shall have black baked enamel finish.
4. Rack mounted equipment shall be provided with security covers where indicated in the equipment list to avoid tampering with preset levels. If manufacturer does not provide suitable security covers for a specified device, Contractor shall provide alternate such as Middle Atlantic SF series.
5. All rack mounted equipment shall be utilize security screws such as Middle Atlantic H-T.
6. All internal rack wiring of microphone and line level cable shall be Belden #8451.

iv. Loudspeakers and Associated Equipment:

1. All loudspeakers shall be phased together – 12 AWG cable to each speaker.

v. Loudspeaker:
   1. Layout and mounting arrangements of loudspeakers shall be as required to provide specified coverage of the seating area.
   2. Loudspeakers shall be easily removable and replaceable in the same position shall have safety cable attachment to framework.
   3. There shall be resilient mounting between the loudspeaker and support structure in the form of #W30N neoprene hangers, as manufactured by Mason Industries, or equal. Isolators shall provide a minimum of 90% Isolation at 20Hz.
   4. Design of the suspension arrangement, exact mounting details and aiming shall be indicated on the shop drawing submitted to the Consultant for review prior to installation. Coordinate scaffolding or moveable lift requirements for access to the speaker location with the General Contractor.

vi. Receptacle Plates
   1. Receptacle plates shall be provided as indicated on the drawings. Coordinate exact sizes and orientation with Electrical Contractor who shall provide back- boxes.
   2. Receptacle plates shall be provided with terminal strips wired to receptacles to facilitate termination to cable in conduit. Field soldering shall not be permitted unless specifically approved by the Consultant.
   3. Finish for all wall mounted receptacle plates shall be 1/8" thick anodized black aluminum with engraved white lettering.

c. **MAJOR EQUIPMENT ITEMS**

Fitness Center - Fitness Center AV

Part #	Item	Quantity
LWR-1223	Rack-Sectional Wall Mount-12U, 23inD, 1pr Adj Rails, Blk	1.00
LFD-12FV	Door-Fully Vented Front-12U, Locking, Blk	1.00
PDX-920R	20A 9 OUT MULTI-STAGE SURGE W/CTRL	1.00
AZMP4-D	Atmosphereâ„¢ 4-Zone Signal Processor with 600-Watt Amplifier and Dante	1.00
A-XLR-US	Atmosphereâ„¢ Remote XLR Input (White)	1.00
A-BT-US	Atmosphereâ„¢ Remote Bluetoothâ„¢ Audio Input (White)	1.00
Control 60PS/T	Control 60PS/T High Impact Direct Radiating Pendant Subwoofer with Built-In Crossover, 8" (200 mm) long-excursion driver, 150W cont. pink noise (300W program) power handling (100hr), 88dB sensitivity, 42Hz - 350Hz frequency range, 110W 70V/100V multi-tap transformer with 8â„¦ direct. Includes suspension hardware with 2x15' (4.5m) galvanized steel cables and easy to adjust clamps, IP44 rated, UL listed (speaker and hanging cable system), black (Priced as each; sold in pairs)	2.00

DIVISION 27 – COMMUNICATIONS

SECTION 274116 – AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

Part #	Item	Quantity
Control 67HC/T	Control 67HC/T Narrow-Coverage High Ceiling Premium RBI Pendant Loudspeaker with 6.5" (165mm) woofer and 1" (25mm) Tweeter, 75W cont. pink noise (300W peak) power handling (100hr), 93dB sensitivity, 75Hz - 17kHz frequency range, narrow 75Â° conical coverage featuring JBL's Radiation Boundary IntegratorÂ® (RBIâ„¢) technology, 60W 70V/100V multi-tap transformer with 8â„¦ direct. Includes suspension hardware with 2x15' (4.5m) galvanized steel cables and easy to adjust clamps, IP44 rated, UL listed (speaker and hanging cable system), black (Priced as each; sold in pairs)	8.00
SLXD24D/B58-G58	Dual Wireless Vocal System with BETA 58	1.00
SLXD1=-G58	Bodypack Transmitter	1.00
SM31FH-TQG	SM31FH Fitness Headset Condenser Microphone	1.00
AC-CX-84	8x4 ConferX Auto Switching Matrix w/ HDBaseT Inputs and Outputs.? Microphone, Volume and Line Level Audio	1.00
AC-CXWP-HDMO-T	HDMI Single Gang, Decora Wall Plate HDBaseT Transmitter ONLY (100M HD, 70M 4K) Color: White	2.00
AC-EX70-444-RNE-P	HDBaseT (CAT6) RECEIVER ONLY. ICT 18G, 70m 4K (100m HD) Slim Extender with I-Pass, Bi-Directional Power, RS232, IR - ICT for full HDR/HDMI Pass-Through. Full HDR, 4K60 4:4:4. INCLUDES PSU	2.00
	Philips 86BDL4650D/00 86" 3840 x 2160 UHD, 500nits, 24/7, OPS Slot, Android SoC Display	2.00
FPIWMS	Tempo Flat Panel In-Wall Mount System	2.00
CP4N	4-Seriesâ„¢ Control System	1.00
TSW-770-B-S	7 in. Wall Mount Touch Screen, Black Smooth	1.00
254346ABK1000	4P 23G CAT6A UTP CMP	2.00
25226BGY1000	1P 14G STRD UNSHLD PLENII	1.00
254246EZGN1000	4P 23G SLD CAT 6 PLENUM	2.00

AV Systems - Large Cafeteria Room 144

Part #	Item	Quantity
LWR-2423	Rack-Sectional Wall Mount-24U, 23inD, 1pr Adj Rails, Blk	1.00
LFD-24FV	Door-Fully Vented Front-24U, Locking, Blk	1.00
PDX-920R	20A 9 OUT MULTI-STAGE SURGE W/CTRL	1.00
GSM4230P-100-NAS	M4250-26G4F-POE+ MNGD SWITCH PERP	1.00
CP4N	4-Seriesâ„¢ Control System	1.00
TSW-770-B-S	7 in. Wall Mount Touch Screen, Black Smooth	1.00
AC-MXNET-CBOX-B	Control Box for MXNET System	1.00
AC-MXNET-1G-R15	MXnet 1G rack mount solution, able to hold 15 products, takes up 6U in the rack	1.00
AC-MXNET-1G-EV2WP	MXnet Evolution II AV-over-IP wall plate encoder with switchable HDMI and USB-C inputs--Not Compatible with V1 Systems	2.00
AC-MXNET-1G-EV2	MXNet 1G Evolution II Encoder --- Not Compatible with V1 Systems	2.00
AC-MXNET-1G-DV2	MXNet 1G Evolution II Decoder --Not Compatible with V1 Systems	5.00
FPIWMS	Tempo Flat Panel In-Wall Mount System	4.00
	Philips/65BDL4650D/00 65" 3840 x 2160 UHD, 500nit, 24/7, Android SoC Display, OPS slot	3.00
	Philips 75BDL4650D/00 75" 3840 x 2160 UHD, 500nits, 24/7, OPS slot, Android SoC Display	1.00

DIVISION 27 – COMMUNICATIONS

SECTION 274116 – AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

Part #	Item	Quantity
D3LK	3SP ANOD DRAWER W/LOCK	1.00
Prism 8x8 Dante	Programmable DSP, 8 mic/line in, 8 line out, 64x64 Dante, ARC	1.00
SLXD24D/B58-G58	Dual Wireless Vocal System with BETA 58	2.00
DISTRO4	4-Channel UHF Antenna Distribution System (470 to 952 MHz)	1.00
DCi4x300D	DCI4300 DANTE	1.00
FC-6T	6" Premium Ceiling Speaker (Blind Mount)	16.00
254346ABK1000	4P 23G CAT6A UTP CMP	1.00
25226BGY1000	1P 14G STRD UNSHLD PLENII	2.00
254246EZGN1000	4P 23G SLD CAT 6 PLENUM	2.00

Small Cafeteria Room 158

NOTE: Connects to Rack in Large Cafeteria

Part #	Item	Quantity
TSW-770-B-S	7 in. Wall Mount Touch Screen, Black Smooth	1.00
AC-MXNET-1G-EV2WP	MXnet Evolution II AV-over-IP wall plate encoder with switchable HDMI and USB-C inputs--Not Compatible with V1 Systems	2.00
AC-MXNET-1G-EV2	MXNet 1G Evolution II Encoder --- Not Compatible with V1 Systems	2.00
AC-MXNET-1G-DV2	MXNet 1G Evolution II Decoder --Not Compatible with V1 Systems	3.00
FPIWMS	Tempo Flat Panel In-Wall Mount System	2.00
	Philips 75BDL4650D/00 75" 3840 x 2160 UHD, 500nits, 24/7, OPS slot, Android SoC Display	2.00
FC-6T	6" Premium Ceiling Speaker (Blind Mount)	14.00
254346ABK1000	4P 23G CAT6A UTP CMP	1.00
25226BGY1000	1P 14G STRD UNSHLD PLENII	2.00
254246EZGN1000	4P 23G SLD CAT 6 PLENUM	2.00

Classroom 102

Part #	Item	Quantity
LWR-1223	Rack-Sectional Wall Mount-12U, 23inD, 1pr Adj Rails, Blk	1.00
LFD-12FV	Door-Fully Vented Front-12U, Locking, Blk	1.00
PDX-920R	20A 9 OUT MULTI-STAGE SURGE W/CTRL	1.00
AZMP4-D	Atmosphereâ„¢ 4-Zone Signal Processor with 600-Watt Amplifier and Dante	1.00
A-XLR-US	Atmosphereâ„¢ Remote XLR Input (White)	1.00
A-BT-US	Atmosphereâ„¢ Remote Bluetoothâ„¢ Audio Input (White)	1.00
FC-6T	6" Premium Ceiling Speaker (Blind Mount)	4.00
AC-CX-84	8x4 ConferX Auto Switching Matrix w/ HDBaseT Inputs and Outputs.? Microphone, Volume and Line Level Audio	1.00
SLXD24D/B58-G58	Dual Wireless Vocal System with BETA 58	1.00
SLXD1=-G58	Bodypack Transmitter	1.00
MX153B/O-TQG	Omnidirectional Earset Headworn Microphone, Black	1.00
AC-CXWP-HDMO-T	HDMI Single Gang, Decora Wall Plate HDBaseT Transmitter ONLY (100M HD, 70M 4K) Color: White	2.00
	Avocor/AVL-1050-T L Series 105 5K PCAP LED Interactive Display 21:9	1.00
KITXWXSM1U	Micro-Adjust Wall Mount XX-Large	1.00
CP4N	4-Seriesâ„¢ Control System	1.00
TSW-770-B-S	7 in. Wall Mount Touch Screen, Black Smooth	1.00
254236FBK1000	4PR 23G SHLD CAT6 CMP	1.00
25226BGY1000	1P 14G STRD UNSHLD PLENII	2.00

DIVISION 27 – COMMUNICATIONS

SECTION 274116 – AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

Part #	Item	Quantity
254246EZGN1000	4P 23G SLD CAT 6 PLENUM	1.00
L5-TURFR-33LDW	L5 TURRET FRAME,LD,LW33W	1.00
L5KBB2SEHC8ZP002	L5K,33W,TUR,SOT,H,C8,DZP	1.00
L5-SD7	L5 STORAGE DRAWER,7 IN	1.00
L5-DCD23	L5 DOC CAM DRAWER,23IN	1.00

Classroom 106

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	4.00
	Philips 50BDL4650D/00 50" 3840 x 2160 UHD, 500nits, 24/7, Android SoC Display	4.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	8.00
	SP-8000-E5-AL Solstice Pod Gen3 Unlimited with 5 years Active Learning Subscription	4.00
CG41042	HDMI Decora Passthrough WP Aluminum	4.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	8.00

Classroom 107

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	1.00
	Promethean ActivPanel 9 Pro 75" Interactive Touch Screen Display	1.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	4.00
CG41042	HDMI Decora Passthrough WP Aluminum	1.00
AC-EX100-444-KIT	HDBaseT (CAT6) Extender Kit. ICT 18G, 100m 4K (100m HD) Extender with I-Pass, Bi-Directional Power, RS232, IR - ICT for full HDR/HDMI Pass-Through. Full HDR, 4K60 4:4:4. PLUS - ARC & Host/Device USB 2.0 (KVM); Has bi-directional USB host.	1.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	1.00

Conference Room 128

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	1.00
	Promethean ActivPanel 9 Pro 75" Interactive Touch Screen Display	1.00
TC Bar M US	TeamConnect Bar M all-in-one audio and video conferencing device for mid-sized meeting rooms and collaboration spaces. Includes (1) TeamConnect Bar S, (1) Mounting Bracket, (1) PSU or POE Power Supply, (1) IR Remote Control with batteries, mounting bracket & storage, (1) Magnetic Lens Cap, (1) HDMI Cable, (1) USB-C to USB-A cable, Dante audio input and output	1.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	4.00
	SP-8000-E5-AL Solstice Pod Gen3 Unlimited with 5 years Active Learning Subscription	1.00
CG41042	HDMI Decora Passthrough WP Aluminum	1.00
AC-EX100-444-KIT	HDBaseT (CAT6) Extender Kit. ICT 18G, 100m 4K (100m HD) Extender with I-Pass, Bi-Directional Power, RS232, IR - ICT for full HDR/HDMI Pass-Through. Full HDR, 4K60 4:4:4. PLUS - ARC & Host/Device USB 2.0 (KVM); Has bi-directional USB host.	1.00

DIVISION 27 – COMMUNICATIONS

SECTION 274116 – AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

Part #	Item	Quantity
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	1.00

College Career Center Room 137

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	1.00
	Promethean ActivPanel 9 Pro 75" Interactive Touch Screen Display	1.00
TC Bar M US	TeamConnect Bar M all-in-one audio and video conferencing device for mid-sized meeting rooms and collaboration spaces. Includes (1) TeamConnect Bar S, (1) Mounting Bracket, (1) PSU or POE Power Supply, (1) IR Remote Control with batteries, mounting bracket & storage, (1) Magnetic Lens Cap, (1) HDMI Cable, (1) USB-C to USB-A cable, Dante audio input and output	1.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	4.00
	SP-8000-E5-AL Solstice Pod Gen3 Unlimited with 5 years Active Learning Subscription	1.00
CG41042	HDMI Decora Passthrough WP Aluminum	1.00
AC-EX100-444-KIT	HDBaseT (CAT6) Extender Kit. ICT 18G, 100m 4K (100m HD) Extender with I-Pass, Bi-Directional Power, RS232, IR - ICT for full HDR/HDMI Pass-Through. Full HDR, 4K60 4:4:4. PLUS - ARC & Host/Device USB 2.0 (KVM); Has bi-directional USB host.	1.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	1.00

Serving Line Rm 148 Digital Signage

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	2.00
	Philips 50BDL4650D/00 50" 3840 x 2160 UHD, 500nits, 24/7, Android SoC Display	2.00
	Brightsign XT245 Powerful ultra-thin player	1.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	4.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	2.00

Art Gallery

Part #	Item	Quantity
LWR-1223	Rack-Sectional Wall Mount-12U, 23inD, 1pr Adj Rails, Blk	1.00
LFD-12FV	Door-Fully Vented Front-12U, Locking, Blk	1.00
PDX-920R	20A 9 OUT MULTI-STAGE SURGE W/CTRL	1.00
AZMP4-D	Atmosphereâ„¢ 4-Zone Signal Processor with 600-Watt Amplifier and Dante	1.00
A-XLR-US	Atmosphereâ„¢ Remote XLR Input (White)	1.00
A-BT-US	Atmosphereâ„¢ Remote Bluetoothâ„¢ Audio Input (White)	1.00
FC-6T	6" Premium Ceiling Speaker (Blind Mount)	8.00
FC-8ST	8" Premium Ceiling Subwoofer (Blind Mount)	2.00
SLXD24D/B58-G58	Dual Wireless Vocal System with BETA 58	1.00
AC-CX-84	8x4 ConferX Auto Switching Matrix w/ HDBaseT Inputs and Outputs.? Microphone, Volume and Line Level Audio	1.00
AC-CXWP-HDMO-T	HDMI Single Gang, Decora Wall Plate HDBaseT Transmitter ONLY (100M HD, 70M 4K) Color: White	2.00
	Philips/98BDL4650D/00 98" 3840 x 2160 UHD, 500nits, 24/7, OPS slot, Android SoC Display	1.00
KITXWXSM1U	Micro-Adjust Wall Mount XX-Large	1.00

DIVISION 27 – COMMUNICATIONS

SECTION 274116 – AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

Part #	Item	Quantity
CP4N	4-Seriesâ„¢ Control System	1.00
TSW-770-B-S	7 in. Wall Mount Touch Screen, Black Smooth	1.00
254236FBK1000	4PR 23G SHLD CAT6 CMP	1.00
25226BGY1000	1P 14G STRD UNSHLD PLENII	2.00
254246EZGN1000	4P 23G SLD CAT 6 PLENUM	1.00

Library Digital Signage

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	2.00
	Philips 50BDL4650D/00 50" 3840 x 2160 UHD, 500nits, 24/7, Android SoC Display	2.00
	Brightsign XT245 Powerful ultra-thin player	2.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	4.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	2.00

Conference Room 163

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	1.00
	Promethean ActivPanel 9 Pro 75" Interactive Touch Screen Display	1.00
TC Bar M US	TeamConnect Bar M all-in-one audio and video conferencing device for mid-sized meeting rooms and collaboration spaces. Includes (1) TeamConnect Bar S, (1) Mounting Bracket, (1) PSU or POE Power Supply, (1) IR Remote Control with batteries, mounting bracket & storage, (1) Magnetic Lens Cap, (1) HDMI Cable, (1) USB-C to USB-A cable, Dante audio input and output	1.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	4.00
	SP-8000-E5-AL Solstice Pod Gen3 Unlimited with 5 years Active Learning Subscription	1.00
CG41042	HDMI Decora Passthrough WP Aluminum	1.00
AC-EX100-444-KIT	HDBaseT (CAT6) Extender Kit. ICT 18G, 100m 4K (100m HD) Extender with I-Pass, Bi-Directional Power, RS232, IR - ICT for full HDR/HDMI Pass-Through. Full HDR, 4K60 4:4:4. PLUS - ARC & Host/Device USB 2.0 (KVM); Has bi-directional USB host.	1.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	1.00

Guidance Office Digital Signage

Part #	Item	Quantity
FPIWMS	Tempo Flat Panel In-Wall Mount System	1.00
	Philips 50BDL4650D/00 50" 3840 x 2160 UHD, 500nits, 24/7, Android SoC Display	1.00
	Brightsign XT245 Powerful ultra-thin player	1.00
254346ABL1000	4P 23G CAT6A UTP CMP	2.00
KJ458MT-C6A-GN	Category 6A MT-Series High-Density Keystone Jack, T568A/B, Green	2.00
AC-BT02-AUHD	Bullet Train 2 Meter HDMI Cable (6.5FT) - 18Gbps Ultra High Speed	1.00

III. EXECUTION

a. INSPECTION

PART 1 - GENERAL

i. Examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Owner for correction. Commencement of work will be construed as complete acceptance of existing conditions.

b. INSTALLATION GENERAL

i. The Contractor shall supply all racks, furniture, consoles, etc., required for the installation, and needed to provide completed systems. Only to the extent that such ancillary equipment is specified elsewhere is it excluded from these system specifications.

ii. All conduits and high-voltage power to be run by District retained electrical contractor

iii. All equipment except portable equipment shall be held firmly in place. This shall include loudspeakers, cables, control equipment, rack equipment, etc. Mountings shall be rigid except where resilient isolation is required, such as with loudspeaker clusters. Fastenings and supports shall be adequate to support their loads with a safety factor of at least five (5).

iv. All switches, jacks, outlets, cables, etc., shall be clearly, logically and permanently marked during installation. All cables shall be marked with standard alphanumeric markers at each end. These markers codes shall be identical to those noted on the shop drawings.

v. The Contractor shall take such precautions as are necessary to prevent and guard against electromagnetic/electrostatic/radio frequency interference.

vi. Care shall be exercised in wiring, so as to avoid damage to the cables and to the equipment. Between racks, cabinets, consoles or modules all cables shall be well supported and shall be neatly laced and dressed. All joints and connections shall be made with rosin-core solder or with mechanical connectors approved by the Consultant. Between racks, cabinets, consoles or modules, all cable shall terminate in terminal connectors, strips, blocks or boards.

vii. All audio wiring shall be executed in strict adherence to standard broadcast practices as detailed in "Sound System Engineering" 2nd Edition, by Don and Carol Davis.

viii. All power level circuits shall be run on the right side of the rack or cabinet as viewed from the rear. All other circuits shall be run on the left side as viewed from the rear.

ix. Microphone and 600-ohm line conduits shall be mechanically and electrically connected to receptacles boxes, and electrically grounded to the ground bus in the power panel.

x. Microphone line shields shall be grounded only at the end that terminates at the equipment rack(s) and shall be grounded only to the common ground of the equipment rack. All audio grounds in the equipment rack(s) shall be connected to a common point on the rack. All racks then shall be grounded to a single point at the power panel buss bar by means of a minimum AWG #4 insulated conductor. The grounding conductor conduit shall be totally electrically isolated from the equipment racks and from the ground panel by means of plastic bushings or other similar approved means.

xi. The total resistance of the ground system from the equipment racks to the power panel ground shall not exceed .1 ohm.

xii. Other shields shall be grounded only at the power amplifier inputs or the console outputs, and shall be terminated at the "floating" end with "wedge on" collars, or

with plastic tape. Continuity of shield shall be preserved at connecting points. Under no circumstances shall the AC neutral be used as a reference ground. As stated above, audio shields shall be connected to ground at a common point.

xiii. Final location of all equipment shall be located as shown on the drawings, or as located in the field or as shown on supplementary drawings prepared by the Consultant.

xiv. Drawings are diagrammatic and indicate general arrangement of systems and work included. Follow drawings in laying out work and check drawings of other trades relating to work to verify spaces in which work will be installed. Maintain headroom and space conditions to all points.

xv. Provide a framed functional diagram for system equipment that reflects the final as-built systems at each rack location.

xvi. Equipment racks shall be pre-wire in Contractor's shop and thoroughly tested for proper signal flow and equipment function prior to delivery of racks to the job site.

xvii. Between racks, cabinets, remote receptacles, all speaker level cable shall terminate in terminal strips.

xviii. A punch block shall be dedicated for use with each audio patch panel. Any audio circuit terminating in a patch panel shall interface through a punch block. Patch panels shall be wired so all signal sources (outputs from equipment), shall be connected to the bottom row. Any efficient combination of top and bottom rows shall be used for multiples.

xix. Drawings are diagrammatic and indicate general arrangement of systems and work included. Follow drawings in laying out work and check drawings of other trades relating to work to verify spaces in which work will be installed. Maintain headroom and space conditions to all points.

xx. Final location of all equipment shall be located as shown on reviewed shop drawings, or as located in the field by the Consultant

c. WORKMANSHIP

i. The installation of all work shall be neat. All work, equipment, etc., shall be plumb and square.

ii. The Contractor shall keep the job adequately staffed at all times. Unless illness, loss of personnel, or other circumstances beyond the control of the Contractor intervene, he shall keep the same individual in charge throughout its execution and shall exercise engineering supervision over the entire installation and shall inspect the installation at least twice prior to acceptance testing.

iii. Following installation, all soiled, abraded or discolored surfaces of work installed herein will be cleaned and left free from blemishes or defects

iv. Work that is damaged or improperly installed will be removed and replaced and the entire installation left in complete satisfactory condition.

v. Any damage to the facility, of any kind, brought about by Contractor's work shall be repaired at no cost to the Owner.

vi. It shall be the responsibility of the Contractor to cooperate with other trades. In order to achieve well-coordinated progress and satisfactory final results. He shall watch for conflicts with work of other contractors on the job and execute, without claim for extra payment, moves or changes as are necessary to accommodate other equipment or preserve symmetry and pleasing appearance.

d. CLEANING

PART 1 - GENERAL

i. The Contractor shall remove from the job site all rubbish and refuse at the end of each day and shall keep his work area clean.
ii. Following Installation, all soiled, abraded or discolored surfaces of work installed herein shall be cleaned and left free from blemishes or defects.
iii. Work that is damaged or improperly installed shall be removed and replaced and the entire installation left in complete satisfactory condition.
iv. Clean the areas affected by the Work to a level of operational cleanliness.
v. Uncover all areas protected during fabrication. Dispose of covering material and debris accordingly.

e. ACCEPTANCE TESTING GENERAL
   i. Upon completion and wiring checkout and initial tests of the systems by Contractor, notify Owner and Consultant in writing that systems are ready for inspection.
   ii. Contractor shall demonstrate the operation of each component of the system to the Consultant and Owner's representative.
   iii. In case the need for further adjustments becomes evident during the demonstration and testing, Contractor's work shall be continued until the systems operate properly.

f. SYSTEM TESTS AND ADJUSTMENTS
   i. Initial tests and adjustments shall be performed by this Contractor who shall include the cost of these tests in his bid proposal. He shall furnish all equipment necessary and perform all work required to determine or modify the performance of the system in accordance with the specifications. Prior to equalization of the sound system, he shall carry out the following inspections of the sound system and submit to the Consultant the written results at each inspection for inclusion on the permanent records of the sound system.
      1. Verify signal flow through the entire system.
      2. Measure and record polarity, distortion, and parasitic oscillation, by use of an oscilloscope and oscillator. Begin by applying signal to the systems input; (usually a mixer), and observe the devices output. Once the first device has been tested and is operating correctly, connect oscilloscope and oscillator to the next device down the line, and proceed with each device until all have been checked.
      3. Measure and record the frequency response of each mixer/preamp in the system.
      4. Measure and record the impedance of each loudspeaker line before connecting it to the output of its respective amplifier, and confirm that it is equal to or above the rated impedance.
      5. Measure and record, with an oscilloscope, the output of each power amplifier. The input source to each amplifier being measured shall be a sine-wave oscillator with less than 0.5% frequency accuracy and adjusted to 10 dB less than fall power output of the amplifier. Ascertain that full voltage for rated power can be reached without noticeable deformation of the wave form. Inspect the output sine-wave appearing on the oscilloscope for complete freedom from spurious oscillation, hum, noise, radio frequency interference, or other unexpected additional outputs.
      6. Measure and record Z (in), Z(load), E(in), and E(out) for each of the power amplifiers.

7. Measure and record input Z(in) and output Z(out) circuit voltage impedances, open circuit voltage E(o), and input E(in) of all speech or music equipment, line amplifiers, and signal processors.
8. Measure and record the phasing of all loudspeakers.
9. Measure and record the polarity of all microphones to be used in the system.
10. Check all microphone lines and other interconnecting cable for correct wiring and shorts to ground.
11. The remote control shall be checked out for specified operation function requirements. "Remote" shall include operation of the portable system in conjunction with the fixed systems
12. Balance the levels of the loudspeaker units driven by different amplifiers in the same system to assure adequate coverage and level of sound from all loudspeakers.
13. Establish the normal settings for all level controls. All level controls on rack-mounted equipment shall be adjusted for optimum signal to noise ratio and signal balance and shall then be capped to prevent tampering. Response shall not vary more than +/- 3dB at any location on the field house floor or at the seating area
14. Prior to equalization of the system use a sweeping sine wave at the systems input to check loudspeaker cluster for extraneous noise. Even coverage of system should be confirmed by use of pink noise and handheld 1/3 octave real time analyzer. Observe variations in both level and spectrum shape while walking the seating area. If coverage problems are evident, improve coverage by re-aiming the loudspeakers. Provide all required scaffolding to access the clusters during the testing adjustment.

ii. Equalization:

1. Provide the following minimal standard laboratory test equipment. Sound level meter and calibrator, 1/3 and 1/10 octave band analyzer, sine and square wave generator, impedance (CRL) bridge, distortion analyzer, calibrated microphone, audio oscilloscope or real-time spectrum analyzer, TEF System 20 (TDS) or SIMM, pink noise generator. This instrumentation shall be the product of Crown, Meyer, General Radio, Bruel & Kjaer, Tektronix, Hewlett-Packard or other approved national manufacturers.
2. Using a calibrated measuring microphone located in the seating area at twice the critical distance (at which direct sound from the source and reverberant sound are in a ratio of 1: 1), establish the un-equalized acoustic amplitude response to a pink noise source. Bring the observed acoustic amplitude to within +/- 3dB uniformity (flat) from 63 to 8,000 Hz. Initially, the roll off at the low frequency end shall be set at 24dB/octave below 31.5 Hz. Initially, the roll off at the high frequency end shall be 3 dB/octave above 16kHz. Adjustments to these settings may be required following initial listening tests.
3. Adjust the sound system gain until it reaches regeneration (feedback). The frequency of regeneration shall be determined by oscilloscope or real-time spectrum analyzer. Adjust the appropriate filter until the observed regeneration ceases.

iii. The following test documentation shall be provided:
    1. List of personnel and certified test equipment used.
    2. Impedance of all loudspeaker lines.
    3. The input and output impedance of all active devices used to terminate passive devices and the value of any termination resistor used.
    4. The variation of acoustic distribution throughout the field house floor area above and below a reference level at each 1/3 octave center frequency from 63- 8,000 Hz.
    5. The recorded polarity and phase measurements of the loudspeakers.
    6. The recorded inspection results observed for hum, noise, parasitic oscillation, and RF interference from the output of each power amplifier.
    7. Normal settings of all system electronics.

iv. Equipment Tests:
    1. All equipment will be tested for proper operation. If any equipment does not appear to be functioning properly, further tests may be performed to determine whether it meets the pertinent specifications. Any measurements deemed necessary by the Consultant may be made to determine proper function.

g. COMPLETION AND NOTIFICATION
    i. Upon completion of installation of equipment, wiring checkout notify Consultant.

h. ACCEPTANCE TESTING
    i. Contractor shall demonstrate operation of each component of the systems to the Consultant and Owner's representative. Written notice shall be at least ten days prior to that date.
    ii. In case the need for further adjustments becomes evident during the demonstration and testing, Contractor's work shall be continued until the systems operate properly. In case the need for further adjustments becomes evident during the demonstration and testing, the Contractor's work shall be continued until the systems operate properly.
    iii. When Final Acceptance testing has concluded to the Owner and Consultant's satisfaction, Contractor shall submit a written request for Final Acceptance. Guarantees, warranties and service contracts will continence upon written notification of Final Acceptance by the Consultant.

i. INSTRUCTION
    i. Within two working weeks of system acceptance, the Contractor shall commence a series of training sessions for persons designated by the Owner. A total of eight (8) hours of training, at mutually acceptable times, shall be provided during a four week period. Contractor shall submit names and period of attendance of those instructed.

END OF SECTION

DIVISION 27 – COMMUNICATIONS

SECTION 275116.10 – PUBLIC ADDRESS SOUND SYSTEM – MODIFY/ EXPAND EXISTING SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes, but not limited to:

1. Conduit and wiring necessary to connect the existing PA head end to area speakers and/or intercom handsets in new or renovated areas.
2. Pre-assembled drop-in ceiling speakers
3. Recessed ceiling speakers
4. Surface mounted box speakers – wall or ceiling
5. Outdoor rated reentrant horn speakers
6. Desk Mounted Administrative Telephone
7. Desk or Wall Mounted Staff Telephone
8. Desk or Wall mounted intercom handsets
9. Volume Controllers
10. Voice Activated Relays

C. Work scope:

1. Work shall include any or all the following:

a. Removal of existing devices no longer required as a result of demolition activities in the project area, as indicated in the Drawings. Demolition work shall include removal of device(s), the removal or surface mounted or exposed backboxes, or the abandonment of recessed backboxes, and removal of any associated wiring, and raceways rendered obsolete by the demolition. It shall also include any programming required to remove such devices from the system. All removed devices shall be turned over to the Owner, unless otherwise noted.

b. Removal and re-installation of existing devices and/or associated wiring to accommodate new finish work or equipment replacements by others.

c. Re-location of existing devices and/or wiring associated with renovated areas. Work shall include all wiring extensions as per code and manufacturer specifications to serve the device at its new location.

d. Addition of new devices, backboxes, grilles and wiring to serve new or renovated areas as shown on the drawings. Included in this work shall be all programming required to integrate the new devices into the system. New devices can include, but not be limited to:

1) Public address speaker(s), ceiling or wall-mounted, surface or recessed mounted.
2) Call initiation switches capable of placing normal, urgent or emergency calls.

3) Wall-mounted paging horns
4) Handsets
5) Volume controllers
6) Take over relays to take over standalone sound systems that may be present in Auditoriums, Cafeterias, Gymnasiums, etc.

2. It is the declared intent of this specification that the end result of the system modifications shall be a complete and operational Public Address system. Provide all required amplifiers, power supplies, batteries, interfaces, programming, inspections, testing, etc. to achieve this result whether or not specific devices are shown on the drawings or are included in this specification.

1.02 SUBMITTALS

A. Product Data: Submit manufacturers standard catalog cuts, specifications and installation instructions for all new devices, components, etc. including wiring. Catalog sheets shall be clearly highlighted to show selected models, accessories, options etc.

1.03 QUALITY ASSURANCE

A. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least 5 years. The contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

C. The contractor shall show satisfactory evidence, upon request, that he or she maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The contractor shall maintain at his or her facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

1.04 SINGLE SOURCE RESPONSIBILITY

A. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and minimum of 35 years' experience in the industry. The supplying contractor shall have attended the manufacturer's installation and service school. A certificate of this training shall be provided with the contractor's submittal.

1.05 SAFETY / COMPLIANCE TESTING

A. The communications system shall bear the label of a Nationally Recognized Testing Laboratory (NRTL) such as ETL and be listed by their re-examination service. All work must be completed in strict accordance with all applicable electrical codes, under direction of a qualified and factory approved distributor, to the approval of the owner.

B. The system is to be designed and configured for maximum ease of service and repair. All major components of the system shall be designed as a standard component of one type of card cage. All internal connections of the system shall be with factory-keyed plugs designed for fault-free connection.

C. The printed circuit card of the card cage shall be silk-screened to indicate the location of each connection.

1.06 WIRING

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall test free from all grounds and shorts.

B. All communication system wiring shall be labeled at both ends of the cable. All labeling shall be based on the room numbers as indicated in the architectural graphics package..

1.07 PROTECTION

A. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.

B. The contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information. Such devices are not to be installed above the ceiling.

1.08 WARRANTY

A. Replace/repair, within the warranty period as specified in the General or Special Provisions of the Contract, all equipment with inadequate and/or defective materials and workmanship, including leakage, breakage, improper assembly or failure to perform as required; provided that the manufacturer's instructions for handling, installing protecting and maintaining units have been adhered to during warranty period. Warranty shall include all component replacement costs, including labor and wring for removal and reinstallation. Such warranty shall be required of the installing contractor even if in excess of original manufacturer warranties.

1.09 PROJECT CONDITIONS

A. The existing public address system shall remain in service throughout the project, except as described below.

B. Interruptions of existing Public Address service: Coordinate any required shutdowns with Owner to tie in new devices. Outages shall only be scheduled during off hours, weekends, holidays etc. when the building is not in use. Include all premium time on bid.

1. Notify Architect, Construction Manager, Owner no fewer than two-days in advance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. All new equipment and wiring shall be compatible for use on the existing system. Manufacturer's specified herein are intended to set quality of product, and not set a requirement to match a given manufacturer's equipment to an existing system.

B. The functionality of the system in new or renovated areas shall meet or exceed that of the existing area or those of similar areas in the building, whichever is greater.

C. The Specifying authority must approve any alternate system.

D. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications.

E. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

2.02 SPEAKERS

A. Pre-assembled drop-in classroom / corridor ceiling speakers shall be listed to UL 1480 and consisting of the following for use on 2' X 2' or 2' X 4' grid suspended ceiling systems:

1. Fully enclosed industrial grade steel assembly.
2. A 2' X 2' perforated grill over the entire front
3. Non-reflective bright white finish,
4. 8"dia. Cone speaker with 10 oz. magnet and tweeter, and 25/70V transformer,
5. Five (5) power taps at 4W, 2W, 1W, 1/2W & 1/4W selectable by rotary switch.
6. Output shall be 94 dB at 1 W / 1 meter and frequency response of 95 Khz to 20 Khz,
7. Four (4) attachment points
8. Tile support for use in 2' X 4' ceiling grid systems.
9. Provide drop-in ceiling speaker assembly, Bogen #CSD2x2/U or equal.

B. Recessed classroom / corridor ceiling speakers shall be 8" cone-type loudspeaker having a frequency response of at least 50 Hz to 12 kHz. Axial sensitivity shall be 95 dB, measured at 1-watt/4-feet. The loudspeaker shall have a 6 oz. ceramic magnet and a ¾" voice coil. A transformer capable of matching an 8-ohm loudspeaker to a 25-volt or 70-volt line and providing power taps of 4W, 2W, 1W, 1/2W and 1/4W shall be included. The loudspeaker shall be assembled on a 13" steel ceiling grille, finished in bright-white semi-gloss enamel. The assembly depth shall be 3-1/4". Provide Bogen Model #S86T725PG8U or equal.

C. Surface mounted metal box speakers shall include an 8" paper cone speaker with 6 oz. magnet. Frequency response shall be 110 Hz to 15 Khz. Dispersion angle shall be no less than 100°. Sensitivity shall be a minimum of 96 dBspl, measured 1 watt @ 1 meter, on axis. The unit shall incorporate a transformer capable of matching an 8-ohm loudspeaker to a 25-volt or 70-volt line and providing power taps of 4W, 2W, 1W, 1/2W, 1/4W and 1/8W. The speaker enclosure shall be full steel construction and allow for surface mounting and contain Wiremold knockouts. The enclosure shall be painted off-white.

1. Wall mounted units shall be sloped front, angled at 12.5 degrees downward and measuring 11-5/8"W X 11-5/8"H X 4-1/4"D (top) and 3-1/8"D (bottom). Provide Bogen Model #MB8TSQ or equal.

2. Ceiling mounted units shall be flat front measuring 11-5/8"W X 11-5/8"H X 4-1/4"D. Provide Bogen Model #MB8TSL or approved equal.

D. Outdoor speakers shall be reentrant type horn loudspeaker having a frequency response of 225 Hz to 14 KhZ. Rated power shall be 30 Watts, RMS continuous, Sound pressure level as measured 4' on axis with 30-Watt input at 100 Hz shall be at least 125dB. The unit shall incorporate a 7-position weather-sealed switch, to allow matching the loudspeaker to a 35V or 70V constant voltage line. Power handling capacity shall be adjustable to 1.8, 3.7, 7.5, 15, 30 Watts @ 70V, or 1.8, 3.7, 7.5, or 15 Watts @ 25V.

1. The speaker shall be weatherproof, all metal construction, with driver enclosed within a weatherproof housing. The loudspeaker shall include a self-aligning, filed replaceable diaphragm. Screw terminals shall be provided for connection to the audio line.
2. An all-purpose mounting bracket shall provide precise positioning in the vertical and horizontal planes with a single adjustment. The bracket shall include banding slots to permit mounting the loudspeaker on beams or pillars.

3. Bracket and speaker shall be finished in mocha enamel.

4. Provide with wire guards where installed outdoors or other areas subject to impact.

5. Provide Bogen #SPT30A or equal.

2.03 TELEPHONES

A. The enhanced desk staff station telephone(s) shall be a BOGEN Model MCESS desk-type telephone, or approved equivalent.

1. The unit shall be a standard DTMF-dialing telephone with 12-positive action pushbuttons. Phones which provide membrane-type push-button switches shall not be accepted as an equal.

2. The telephone shall be constructed of molded high-impact ABS finished in a permanent beige color. The receiver shall contain a dynamic receiver and cardon transmitter. A coil cord, terminated in standard modular plugs, shall be supplied to connect the handset to the telephone base.

3. The enhanced staff telephone shall permit rapid, efficient, and reliable control of the operational features available to enhanced staff stations in MULTICOM 2000 Communication Systems. The specific features available shall be determined by the station’s access level, as assigned during the initial system configuration programming.

4. When the enhanced staff station is equipped with the telephone alone, connection to the MULTICOM 2000 System shall require only 2 wires. When the enhanced staff station is equipped with the telephone and a loudspeaker, connection to the MULTICOM 2000 System shall require a shielded pair plus one conductor.

5. The telephone shall require 5-1/2" x 9" of desk space and shall be supplied with a modular cord and surface-mounting junction box.

B. The wall mounted enhanced staff station telephone(s) shall be a BOGEN Model MCWESS/V wall-mounting telephone, or approved equivalent.

1. The unit shall be a standard DTMF-dialing telephone with 12-positive action pushbuttons. Phones which provide membrane-type push-button switches shall not be accepted as an equal.

2. The telephone shall be constructed of molded high-impact ABS finished in a permanent beige color. The receiver shall contain a dynamic receiver and car-don transmitter.

3. The enhanced staff telephone shall permit rapid, efficient, and reliable control of the operational features available to enhanced staff stations in MULTICOM 2000 Communication Systems. The specific features available shall be determined by the station's access level, as assigned during the initial system configuration programming.

4. When the enhanced staff station is equipped with the telephone alone, connection to the MULTICOM 2000 System shall require only 2 wires. When the enhanced staff station is equipped with the telephone and a loudspeaker, connection to the MULTICOM 2000 System shall require a shielded pair plus one conductor.
5. The telephone shall require 4" x 9" of wall space. It shall be supplied with a wall-mounting plate which shall fit a standard single-gang box (not supplied). The plate shall be equipped with a modular jack.

6. The unit shall have a 30” armored handset cord.

2.04 ACCESSORIES

A. Volume Controller – UL Listed single gang, 20W ten-step, continuous rotary, audio level attenuator with OFF position. Brushed, stainless steel faceplate with embossed positions and black knob with white indicator mark. Install in standard 2-1/8” deep electrical box. Provide Quam #QC-10 or equal.

B. Voice Activated Relay – DPDT relay device activated when an audio signal is detected at the microphone pre-amp or at the 70V, 25V or 600-ohm line level inputs. A slide switch shall be provided to allow selection of the pre-amp or line inputs. A VOX detect circuit shall be provided and shall include sensitivity and delay controls. The audio output shall be an isolated 600-ohm transformer. Line impedance shall be 600 ohms, with a frequency response of 100 Hz to 10 kHz. Sensitivity and delay shall be controlled by recessed potentiometers. Time delay range Shall be adjustable from approximately 0.25 to 25 seconds. The MIC pre-amp shall provide 62dB gain, with volume control via a recessed potentiometer. The frequency response of the MIC pre-amp shall be 200 Hz to 10kHz. Output signal to noise ration shall be 55 dB. Provide with a 12V to 24V DC power source to operate the relay. Provide Bogen #VAR-1 or approved equal.

2.05 WIRING

A. All wiring shall be plenum rated. Wiring shall be done per manufacturer's recommendation, West Penn #25357. All terminal connections to be on barrier strips. All cables to be labeled by room.

PART 3 - EXECUTION

3.01 FIELD CONDITIONS

A. Examine conditions, with the installer present, for compliance with requirements and other conditions affecting the performance of the Integrated Telecommunications/Time/Audio/Media System.

B. Do not proceed until unsatisfactory conditions have been corrected.

C. Prior to performing any work, perform a test of the devices in the work area to confirm existing operational status. Report any non-functional devices to the Owner’s Representative for corrective action to be taken, if any, at Owner expense. Devices not functioning after this test shall be considered as Contractor fault and shall be repaired or replaced at Contractor expense.

3.02 INSTALLATION

A. The installation, adjustment, testing and final connection of all conduits, wiring, boxes, cabinets, etc., shall conform to local electrical requirements and shall be sized and installed in accordance with manufacturer’s approved shop drawings.

B. Low-voltage wiring may be run exposed above ceiling areas where they are easily accessible.

C. All classroom phones shall be wall mounted.

1. Mount at 54" AFF.
2. All wiring should be concealed.
3. Verify exact location with Architect.

D. All Administrative Phones shall be desk- or counter-mounted.

1. Provide standard wall 120V AC receptacle 16" AFF
2. Verify exact location with Architect.

E. Speaker and telephone lines run above ceiling and not in conduit shall be tie-wrapped to ceiling joist with a maximum spacing of 8' between supports. No wires shall be laid on top of ceiling tile.

F. Connect field cable to each speaker transformer using UL butt splices for 22 AWG wire.

G. Terminate field wiring on wall adjacent to rack using Telco 66 type blocks. Provide neat cross connect system for wiring. Wiring to be labeled to indicate final architectural room number that it services on the Telco block.

H. Rack shall be labeled in numerical order with speaker/phone combinations first, speaker/outside horn combinations last. Labeling and order shall reflect final Architectural room numbers posted outside the rooms. Use three- (3), four- (4), five- (5), or six- (6) digit dialing extensions.

I. Mark and label all telephone outlets and/or set with the graphic room numbers. Label all demarks IDF and MDF points with destination point numbers. Rooms with more than one outlet shall be marked XXX-1, XXX-2, XXX-3, etc. where XXX is the room number.

J. No graphic room number shall exceed the sequence from 000001 through 899999.

1. All outside speakers shall be on a separate page zone and time zone.
2. All zones shall be laid out not to exceed 10 watts maximum audio power zone.
3. All hallway speakers shall be tapped at 1 watt maximum.
4. All outside horns shall be tapped at 7.5 watts maximum.
5. All classroom speakers shall be tapped at ½ watt maximum.
6. Large rooms, such as cafeterias, shall be tapped at 2 watts maximum.

K. Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.

L. Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T & B "Ty-Rap" cable. Edge protection material shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.

M. Cable identification: Cable conductors shall be color-coded, and individual cables shall be individually identified. Each cable identification shall have a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.

N. Shielding: Cable shielding shall be capable of being connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.

O. Provide all system programming necessary to fully integrate new / modified devices into the system.

P. Provide complete "in service" instructions of system operation to school personnel. Assist in programming of telephone system.

3.03 GROUNDING

A. Provide equipment grounding connections for Integrated Telecommunications/Time/Audio/Media System as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.

C. The contractor shall note in his drawing, the type and locations of these protection devices as well as all wiring information.

PART 4 - DOCUMENTATION

4.01 DOCUMENTATION

A. Provide the following directly to the Supervisor of Technology Service.

1. Provide a printed copy of all field programming for all components in system.

2. Provide one copy of all diagnostic software with copy of field program for each unit.

3. Provide one copy of all service manuals, parts list, and internal wiring diagrams of each component of system.

4. Provide one copy of all field wiring runs, location, and end designation of system.

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 281500 – INTEGRATED ACCESS CONTROL HARDWARE

PART 1 – ACCESS CONTROL

1.01 GENERAL

A. The Electrical Contractor(EC) shall provide and install a card access solution which includes HID R40 door station readers for locations shown on the floor plans. The door station card readers shall be integrated to an existing server that sits on the LAN.

B. The new card readers will be connected to the network via new category 6 cable to the nearest wiring closet.

C. The EC shall refer to drawings for location of doors and wiring closet locations.

D. All new hardware shall be listed in accordance with ANSI/UL 294 standard for access control systems.

E. New electric door strikes shall “Fail Safe” such that the panic hardware on the exit doors allows for proper egress from the building under ALL circumstances.

1.02 CONTRACTOR’S RESPONSIBILITIES

A. Stage and configure all hardware included in Bill of Materials and defined within Scope of Work.

B. Test and train the customer on operation.

C. Review and approve Detailed Design Document.

D. Install and certify all required cabling.

E. Perform test Procedure.

1.03 CABLING REQUIREMENTS AS FOLLOWS

A. Plenum rated Cat6 cable from each door station to data closet.

B. Patch cable to patch each door station to network switch.

C. RS-485 cable as manufactured by Belden or equivalent.

1.04 BILL OF MATERIALS FOR EACH DOOR

QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
1	R40 Card Reader	HID R40	HID
1	Door/Reader Interface	Vertx V100	Vertx
1	DTC-4000 Single sided printer, camera and cartridge	BK-1-A	Fargo
1	One year warranty per state contract	One Year Warranty	
1	Programming of system	Programming	
1	Training of Personnel	Training	

PART 2 – BURGLAR SYSTEM

2.01 GENERAL

A. The Security Contractor shall provide and install a burglary alarm system solution which includes a corridor motion detectors and keypads.

2.02 SCOPE OF WORK

A. The intent of this specification is to describe the minimum system requirements selected after exhaustive competitive analysis of available features offered by major suppliers of Security Alarm Systems.

B. System integrity must be constantly supervised and alert administrative personnel of defects and system anomalies.

C. The security system shall have the ability to be integrated to the fire alarm system. This enhancement will alert the Owner's personnel, students, and building occupants to a security encroachment condition, the exact location of the device(s) in alarm, and custom digitized emergency instructions.

D. Installation of all conduits, cable, security equipment, and power wiring shall be provided by a duly licensed Master Electrical Contractor, licensed in the County and Town in which the work is to take place.

E. The Security Equipment Installer shall also include all costs to properly supervise the installation of the security system. This supervision shall include furnishing the equipment as specified, proper location of the devices, assistance to the Owner in procurement of the telephone devices, lines and services, testing of all system components, training of operating personnel, and full field service during the one-year warranty period.

F. The installation shall be accomplished in a workmanlike manner and in strict accordance with all applicable codes governing this type of installation. All devices shall be securely mounted and fastened in place. All connections and/or splices shall be made only in junction boxes using approved crimp-type connectors and with any special tools recommended by the connector manufacturer.

G. All microprocessor-based communication security monitoring components shall be submitted, supplied, installed, tested, commissioned, documented, and demonstrated to the Owner's personnel by a factory trained and certified security system distributor/technician.

H. The Security Equipment Installer shall include all costs associated with providing 6 sets of submittals for the Engineer which shall include working drawings showing proper interconnect wiring between all devices, a list of all devices, and specification sheets on all devices. Also furnish a typed operational narrative on the system including all sequences of operation for use by the operators and for training purposes. It shall explain in detail how the system operates and how to operate the system. Manufacturer's specification sheets will not be accepted for the operational narrative. All of these items shall be submitted in a suitable binder, labeled accordingly.

2.03 SECURITY SYSTEM CONTROL PANEL

A. The Security Control Panels shall be Vista-128BP by Honeywell.

B. Each system including integral digital communicator is contained within a wall mounted enclosure including a transformer and battery backup.

C. The Security Control Panel shall be capable of programmable area partitioning. That is, the system may be divided up into multiple discrete zone areas, each allowing access by only those users programmed for their respective area.

D. A log containing up to 800 events accessible through software shall monitor control panel activity referenced to a precision real-time clock.

E. A detailed event history may be displayed at a computer with an abbreviated display available at the keypad. A printout of the detailed report may be obtained if an optional printer is connected to the system.

2.04 DETECTION EQUIPMENT

A. The general location of all equipment shall be as shown on the drawings. Final location shall be as directed by Owner's representative.

B. Where indicated on the drawings, the Contractor shall furnish and install adaptive passive infrared sensors. The detectors shall contain circuitry to reject common false alarm problems and automatic temperature compensation. Each detector shall have a manual sensitivity adjustment, a LED zone indicator, horizontal optical adjustment, rotational adjustment, alarm memory, and 15mA current consumption.

C. In predetermined areas, the AP633A passive infrared detector manufactured by GE shall be installed including any mounting hardware as required for best coverage.

D. All corridor units shall have a range of 200' x 40'.

2.05 KEYPADS

A. The keypads shall feature a liquid-crystal display for English language messages. In normal daily use, the LCD shall be used for identification and status messages. Keypad shall be model 6148 manufactured by Honeywell.

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 281523.17 – AUDIO VIDEO INTERCOM (IP)

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. IP Video Intercom. (Aiphone IX Series)

1.02 RELATED SECTIONS

A. Section 271501 – Communications and Horizontal Cabling

1.03 REFERENCES

A. American National Standards Institute (ANSI/TIA/EIA) 568 - Commercial Building Telecommunications Cabling Standard.

B. International Organization for Standards (ISO) 9001:2000 - Quality Management Systems - Requirements.

1.04 SYSTEM DESCRIPTION

A. IP Network Compatible Video Intercom System: A network-based communication and security system featuring video entry security, internal communication, emergency stations, and paging. All units and app in the systems shall be able to unlock doors remotely on a network, assist onsite visitors from an offsite location, broadcast emergency announcements, and communicate using a PoE network.

1. Power Source: Power over Ethernet (802.3af).
2. Network Interface: 10 BASE-T / 100 BASE-TX Ethernet (RJ-45).
3. Network Protocols: IPv4, IPv6, TCP, UDP, SIP, HTTP, HTTPS, MJPEG, RTSP, RTP, RTCP, IGMP, MLD, SMTP, DHCP, NTP, DNS.

4. Bandwidth Usage:

    a. G.711: 64Kbps x 2 per video call.
    b. 64Kbps per monitor.
    c. H.264: 24Kbps ~ 2,048Kbps.

5. Communication: Hands-free (VOX), push-to-talk (simplex), or handset (full-duplex).
6. Video Display: 7 inch color LCD.
7. Camera: Type:

    a. 1/3 inch color CMOS. 1.23 Megapixels.
    b. View Area at 0 degree camera angle mounted at 4 feet 11 inches (1500 mm) AFF: 2 feet 3 inches (700 mm) vertical x 3 feet 9 inch (1150 mm) horizontal at 19 inches (500 mm).

8. Video Stream: ONVIF Profile S.
9. Door Release: Programmable Form C dry contact, 24V AC/ DC, 500mA (use RY-24L for larger contact rating, which requires 24V DC power supply) or use RY-IP44 with 4 multipurpose relays.
10. Wire Type: CAT-6.
11. Distance:

a. Any station to Network Node: 330 feet (100 meters).

1.05 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Procedures, and as modified below.
B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit the following:

1. Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.
2. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

D. Installation and Operation Manuals:

1. Submit manufacturer's installation and operation manual, including operation instructions and component wiring diagrams.
2. Provide detailed information required for Owner to properly operate equipment.

E. Warranty: Submit manufacturer's standard warranty.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001:2015 certified company.

B. Installer Qualifications: Factory trained and experienced with system installations of scope and size required for the Project.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship is approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Aiphone Corp., which is located at: 6670 185th Ave. NE; Redmond, WA 98052 ; Toll Free Tel: 800-692-0200; Tel: 425-455-0510; Fax: 425-455-0071; Email: request info (marketing@aiphone.com); Web: http://www.aiphone.com

B. Requests for substitutions will be considered in accordance with provisions noted within the Instructions to Bidders.

C. IP Video Intercom System: IX Series Intercom System as manufactured by Aiphone Corporation.

2.02 SYSTEM DESIGN

A. Master Station(s): Provide ___ master stations.

B. Audio Video Door Stations:

1. Model IX-DA (Surface Mount): Provide ___.
2. Model IX-DV (Video Door Station - Surface Mount - Hands Free): Provide ___.
3. Model IX-DVF (Video Door Station - Flush Mount - Hands Free): Provide ___.
4. Model IX-DVF-P (Video Door Station - Flush Mount - Hands Free): Provide ___.
5. Model IX-DVF-RA (Video Door Station - Flush Mount - Emergency Call Button): Provide ___.
6. Model IX-DVF-2RA (Video Door Station - Flush Mount - Hands Free - Emergency Call Button): Provide ___.

C. Audio Only Door Stations:

1. Model IX-SSA (Video Door Station - Flush Mount - Hands Free): Provide ___.
2. Model IX-SSA-RA (Video Door Station - Flush Mount - Emergency Call Button): Provide ___.
3. Model IX-SSA-2RA (Video Door Station - Flush Mount - Emergency Call Button): Provide ___.
4. Model IX-BA (Surface Mount): Provide ___.
5. Model IX-SS-2G (Recessed Mount): Provide ___.
6. Model IX-SSA (Recessed Mount): Provide ___.

D. Provide Selective Door/Gate Release.

E. Provide Audio/video streaming via ONVIF Profile S.

F. Provide ONVIF Profile S camera input (max 500).

G. Provide Overhead paging.

H. Provide Contact input at door station.

2.03 FUNCTIONAL COMPONENTS:

A. Functional Components: As indicated on the drawings or as required to complete system.

1. Video Master Station Series IX-MV7:

    a. Model IX-MV7-HB (Master Station - Black w/Handset).
    b. Model IX-MV7-HW (Master Station - White w/Handset).
    c. Model IX-MV7-B (Master Station - Black, Hands Free).
    d. Model IX-MV7-W (Master Station - White, Hands Free).
    e. An IP addressable video master station with a 7 inch color LCD monitor. It can be wall or desk mounted (desk stand included). The IX-MV7 offers handset (duplex) and hands-free (VOX/PTT) communication and call up to 500 other IX stations. It connects directly to a network using CAT-6 cable. This station requires a 802.3af compliant Power-over-Ethernet network.

2. Substation Series IX-RS:

    a. Model IX-RS-W (White Handset Substation)
    b. Model IX-RS-B (Black Handset Substation)

3. IXW-MA IP Programmable Relay Adaptor: Multi-purpose adaptor - PoE - screen only. : Provide ___.

4. RY-IP44 IP Programmable Relay Adaptor:

    a. 4 contact inputs and 4 relay outputs (compatible with the IX Series, IS-IP Series, and IPW-1A only).

5. 2-Wire Network Adapter Model IX-1AS:

    a. One 2-wire input with 2 built-in contact outputs; door release and camera call-up. Powered via PoE, Compatible with Aiphone's LE and NE series audio door or substations for connection to Video Master Station Model IX-MV7 over a network.

6. Wire Network Adapter Model IX-10AS (Ten IX-1AS adaptors in a rack mounted enclosure):

    a. Ten 2-wire inputs with ten, 2 built-in contact outputs; door release and camera call-up. Powered via PoE, Compatible with Aiphone LE and NE series audio door or substations for connection to Video Master Station Model IX-MV7 over a network.

7. Network Paging Adapter Model IX-PA:

    a. Address book that supports up to 50 stations and can be connected to 3rd party devices. Can be accessed by an IX-MV7 master station or an instance of the IX Mobile App to allow messages to be broadcast through the IX-PA 600u or 8u output. A 3rd party device can be connected to the audio input to send messages to the paging adaptor address book.

8. Emergency and Assistance Modular Towers: TW-Series.

    a. Modular tower design available in three configurations:

        1) 2-Module, mid-level tower.
        2) 3-Module, dual station tower
        3) 3-Module, high level Tower.

    b. Color: _____.
    c. Lettering Color: _____. For assistance and emergency signage.
    d. Top Cover:

1) Top plate, no light.
2) Light cage with blue beacon and strobe.

e. UL Listed electrical box included in base module
f. Material: 0.25 inch (6.4 mm) zinc treated steel powder coated exterior.
g. Camera arm module option with universal pipe threading (1.50 inch NPT Threading x 1 inch (25 mm) long).
h. Elongated access panel on back of each module for easier installation and wiring.
i. Mounting studs in both top and base modules for internal product (power supply, relay, etc.).
j. Weather and vandal resistant.
k. Mounting: L-brackets, anchor bolts to foundation meeting size requirements of manufacturer.
l. Compatible with IX-Series emergency and assistance stations.
m. Beacon / Strobe is always lit; flashes during emergency call-in (Requires 24V DC).
n. LED light for station illumination in middle module (Requires 24V DC).
o. Call button mounting height and signage meet ADA regulations.
p. Compatibility: Use with IX-DVF-2RA, IX-DVF-RA, IX-SSA-2RA, IX-SSA-RA, IS-DVF-2RA, IS-SS-2RA-R, and IS-SS-RA-R
q. Compatibility with Non-Emergency Call Stations when using the TW-SPL: IX-DVF, IS-DVF, and IS-IPDVF

9. 30 Degree Angle Box Model KAW-D 30:

    a. Designed for use with one gang mountable video door stations.

10. 45 Degree Mullion Mounting Bracket Model KMB-45:

    a. Bracket suitable for mounting any of the 1 gang door stations.

11. Stainless Steel Security Lock Box Model LB-SDVF.

12. Electric Door Strike Model EL-12S:

    a. The door strike is designed for wood framed wooden doors. The unit operates on 12~16 V AC.

13. Stainless Steel Enclosure Model SBX-ISDVF:

    a. 18-Guage Stainless Steel Surface Mount Box for IS-SS/IS-DVF/IS-IPDVF/IX-DF(SS)/IX-DF-HID/RP10 designed for surface mounting door stations.
    b. Size: 10-7/16 inches x 5-15/16 inches x 3-5/16 inches (top); 2-5/16 inches (bottom) (265 mm x 151 mm x 84 mm (top); 59 mm (bottom).
    c. Weather resistant.
    d. Vandal-resistant.
    e. Inside space for cabling.
    f. Mounts to flat wall surface.
    g. Opening at bottom for drainage.

14. Stainless Steel Enclosure Model SBX-IDVFRA:

    a. 18-Guage Stainless Steel Surface Mount Box for IS-DVF-(2)RA, IX-DF-2RA, IX-SS-(2)RA.

b. Size: 11-11/16 inches x 7 inches x 3-5/16 inches (top); 2-5/16 inches (bottom) (297 mm x 178 mm x 84 mm (top); 59 mm (bottom).
c. Weather resistant.
d. Vandal-resistant.
e. Inside space for cabling.
f. Mounts to flat wall surface.
g. Opening at bottom for drainage.

B. Wall Boxes:

1. Product: WB-CA Stainless Steel Wall Mount Box with Blue Assistance Signage and a Light Cage.

   a. ADA (28 CFR Part 36 section 4.4.1) compliant.
   b. Lettering: Reflective lettering on both sides of box.
   c. Blue Beacon and Strobe: Mounted on top, enclosed in vandal resistant cage.
   d. Material: 12-gauge stainless steel.
   e. UL Listed electrical box included. 1-gang pattern internal mounting above UL box
   f. Surface Mounting: 4 inch (102 mm) depth, ADA compliant.
   g. Voltage: 24V DC.
   h. Current: 200 mA.
   i. Service: Vandal and weather resistant.
   j. Compatibility: IX-DVF-2RA, IX-DVF-RA, IX-SSA-2RA, IX-SSA-RA, IS-DVF-2RA, IS-SS-2RA-R, and IS-SS-RA-R emergency and assistance substations.

2. Product: WB-CE Stainless Steel Wall Mount Box with Red Emergency Signage and a Light Cage.

   a. ADA (28 CFR Part 36 section 4.4.1) compliant.
   b. Lettering: Reflective lettering on both sides of box.
   c. Blue Beacon and Strobe: Mounted on top, enclosed in a vandal resistant cage.
   d. Material: 12-gauge stainless steel.
   e. UL Listed electrical box included. 1-gang pattern internal mounting above UL box
   f. Surface Mounting: 4 inch (102 mm) depth, ADA compliant.
   g. Voltage: 24V DC.
   h. Current: 200 mA.
   i. Service: Vandal and weather resistant.
   j. Compatibility: IX-DVF-2RA, IX-DVF-RA, IX-SSA-2RA, IX-SSA-RA, IS-DVF-2RA, IS-SS-2RA-R, and IS-SS-RA-R emergency and assistance substations.

3. Product: WB-HA Stainless Steel Wall Mount Box with Blue Assistance Signage and a Hooded Light.

   a. ADA (28 CFR Part 36 section 4.4.1) compliant.
   b. Lettering: Reflective lettering on both sides of box.
   c. Blue Beacon and Strobe: Mounted on top, enclosed in a vandal resistant stainless steel hood with clear polycarbonate lens.
   d. Material: 12-gauge stainless steel.
   e. UL Listed electrical box included. 1-gang pattern internal mounting above UL box
   f. Surface Mounting: 4 inch (102 mm) depth, ADA compliant.
   g. Voltage: 24V DC.
   h. Current: 200 mA.
   i. Service: Vandal and weather resistant.
   j. Compatibility: IX-DVF-2RA, IX-DVF-RA, IX-SSA-2RA, IX-SSA-RA, IS-DVF-2RA, IS-SS-2RA-R, and IS-SS-RA-R emergency and assistance substations.

4. Product: WB-HE Stainless Steel Wall Mount Box with Red Emergency Signage and a Hooded Light.

    a. ADA (28 CFR Part 36 section 4.4.1) compliant.
    b. Lettering: Reflective lettering on both sides of box.
    c. Blue Beacon and Strobe: Mounted on top, enclosed in a vandal resistant stainless steel hood with clear polycarbonate lens.
    d. Material: 12-gauge stainless steel.
    e. UL Listed electrical box included. 1-gang pattern internal mounting above UL box
    f. Surface Mounting: 4 inch (102 mm) depth, ADA compliant.
    g. Voltage: 24V DC.
    h. Current: 200 mA.
    i. Service: Vandal and weather resistant.
    j. Compatibility: IX-DVF-2RA, IX-DVF-RA, IX-SSA-2RA, IX-SSA-RA, IS-DVF-2RA, IS-SS-2RA-R, and IS-SS-RA-R emergency and assistance substations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive integrated security and communication system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.02 PREPARATION

A. Verify the following compliance before starting installation.

1. The unit turns inoperative during power failure.

2. Keep the intercom wires at least 1 foot (30 cm) away from strong electrical wiring (AC 100-240 V) including, in particular, wiring for inverter electrical appliances. Noise and malfunction could result.

3. If a strong light shines on the main unit screen, the picture may turn white or only silhouettes will be visible.

4. Other manufacturer's devices (such as sensor, detectors, door releases) used with this system, comply with the manufacturer's installation requirements.

5. The LCD panel is manufactured with very high precision techniques, inevitably will have a very small portion of its picture elements always lit or not lit at all. This is not considered a unit malfunction. Please be aware of this in advance.

3.03 INSTALLATION

A. Install integrated security and communication system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Mount equipment plumb, level, square, and secure. For video entrance stations and video door stations, comply with manufacturer's design requirements to provide optimum picture quality of station monitoring.

3.04 SET-UP AND ADJUSTING

A. Adjust integrated security and communication system for proper operation in accordance with manufacturer's instructions.

3.05 DEMONSTRATION AND TRAINING

A. Demonstration:

1. Demonstrate that integrated security and communication system functions properly.

2. Perform demonstration at final system inspection by qualified representative of manufacturer.

B. Instruction and Training:

1. Provide instruction and training of Owner's personnel as required for operation of integrated security and communication system.

2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.

C. Provide instruction and training by qualified representative of manufacturer.

3.06 PROTECTION

A. Protect installed integrated security and communication system from damage during construction.

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 282100 – SURVEILLANCE CAMERAS

PART 1 – GENERAL

1.01 QUALIFICATIONS

A. The Electrical Contractor shall include the services of a qualified NY State licensed Security Contractor to furnish the specified devices and to integrate them into a complete and operable Safety – Security System.

B. The Electrical Contractor shall provide a reference list of five similar sized projects installed within the last three years by the Security Contractor including the name of the person and telephone number of the person to contact at each location. A site visit to any of these locations shall be arranged with the Owner's representative. This is a mandatory requirement.

C. At the time of bid, it is assumed that the bidder is provided the exact system(s) as specified or a system that is equal or better. Failure to meet these requirements will result in disqualification. See also section 1.03 "Alternate Systems".

1.02 SCOPE OF WORK

A. The intent of this specification is to describe the minimum system requirements selected after exhaustive competitive analysis of available features offered by major suppliers of Security Alarm Systems for an integrated Safety – Security System.

B. System integrity must be constantly supervised and alert administrative personnel of defects and system anomalies.

C. Installation of all conduits, cable, security equipment, and power wiring shall be provided by a duly licensed Master Electrical Contractor, licensed in the Country and Town in which the work is to take place.

D. The Electrical Contractor shall also include all costs to properly supervise the installation of the security system by the Security Contractor. This supervision shall include furnishing the equipment as specified, proper location of devices, assistance to the Owner in procurement of the telephone devices, lines and services, testing of all system components, training of operating personnel, and full field service during the two- year warranty period.

   1. The installation shall be accomplished in a workmanlike manner and in strict accordance with manufacturer's requirement and all applicable codes governing this type of installation. All connections and/or splices shall be made only in junction boxes using approved crimp-type connectors and with any special tools recommended by the connector manufacturer. All cables and wiring shall be supported properly by the Electrical Contractor, above hung ceiling, or run where Owner/Engineer has given written approval.

E. All microprocessor-based communication security monitoring components shall be submitted, supplied, installed, tested, commissioned, documented, and demonstrated to the Owner's personnel by a factory trained and certified security system distributor/technician.

F. The Security Contractor shall include all costs associated with providing 8 sets of submittals for the Engineer which shall include working drawings showing proper interconnect wiring between all devices. Also furnish a typed operational narrative on the system including all sequences of operation for the use by the operators and for training purposes. It shall explain in detail how the

system operates and how to operate the system. Manufacturer's specification sheets will not be accepted for the operational narrative. All of these items shall be submitted in a suitable binder, labeled accordingly.

G. The Security Contractor installer shall provide installation and supervision for new system, as well as program all alarm panels and central station computer as per the existing protocol.

H. The Security Contractor shall provide integrated installation drawings on blue line and electronic format. No hand drawings will be accepted.

I. The system shall consist of IP based fixed cameras with appropriate housings, lenses and mounting brackets, Network Video recorders, software, licenses and any switches, hubs, routers, power supplies and plenum rated cables necessary to meet the specifications as shown in Part 2 of this document.

J. The bidder shall propose the appropriate network to meet the design intent of this specification. Bidder shall be responsible for all network configuration of provided equipment as well as submitting with their response any configuration changes that need to be made to the existing network to support the proposed system and meet design objectives.

K. The system shall be capable of recording images from all cameras for a minimum of 10 fps, Normal quality at VGA resolution. This recording shall be retained for no less than two(2) weeks. The system shall be designed with distributed recorders located at each Owners operated site/facility to ensure that the network load is distributed across the network.

L. The system shall be capable of displaying live images from any camera at 30 fps using MPEG-4 onto any client PC with appropriate bandwidth.

M. The proposed system shall support the 802.11af Power over Ethernet standard for all cameras. Bidders may provide 802.11af compliant switches, mid-spans, power injectors or a combination of devices as they feel necessary to provide power to all camera locations. Bidders shall insure that 15 Watts PoE is delivered to all external cameras and 7.5 Watts PoE is delivered to all internal cameras.

N. Cameras shall be located in such a manner as to cover the areas as identified in the drawings for each school building. In addition, **the successful bidder shall provide a JPEG image from each proposed camera location showing the camera view from that location. These views shall be signed off by the designated school administrator.**

O. The system shall be configured to permit the remote viewing of all recorders at all school buildings using a single computer with software meeting the specifications as shown in section 2.07.

P. The system must be capable of working with the existing connectivity between the school buildings. The bandwidth of the streams shall be adjusted in order to permit the streaming of video over these connections. Priority shall be given to the quality of the video over frame rate.

1.03 ALTERNATES

A. This specification section is based upon equipment manufactured by those companies listed herein.

B. Any Security Contractor, submitting alternate systems, must be Approved by the Owner's representative. Any Security Contractor requesting approval must follow these guidelines:

1. Demonstrate the proposed system to the Owner's personnel and representatives.

2. Provide a letter from Underwriters Laboratories that the proposed product is UL listed as a system.

3. Provide a letter from the manufacturer stating the Security System installer's technical personnel have attended factory-trained seminars and are certified to support the product to the Owner.

4. Through the demonstration process, indicate how the proposed system meets or exceeds the specifications. Demonstrate to the Owner all system functions.

5. Furnish factory data sheets on every piece of equipment proposed.

6. Complete lists, descriptions, and drawings or materials to be used.

7. A complete list of current drain requirements during normal Supervisory conditions, trouble conditions, and alarms conditions.

8. Battery standby calculations showing total standby power needed to meet the system requirements as specified.

9. Furnish a line-by-line specification review indicating compliance non-compliance for each function in wiring.

10. Obtain written acceptance of the proposed system from the Owner, Architect, and Engineer.

C. Substitute supervised systems will be considered providing the bidder has submitted the complete system documentation to the Architect. The submission must be complete and meet or exceed all criteria described in this specification. There will be no exceptions to this requirement.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Cameras - Axis or equivalent

B. Milestone Xprotect Expert Software or equivalent

2.02 HOUSING AND MOUNTINGS

A. An appropriate housing and mounting bracket shall be selected to permit the camera to be mounted in the selected location if required.

B. An appropriate weatherproof housing meeting IP66 standard shall be selected for any exterior mounted cameras. All fixed outdoor cameras shall be mounted using wall mount bracket PWM484S or equivalent and provide mounting hardware appropriate to the mounting surface.

PART 3 - WARRANTY

3.01 WARRANTY

A. Products proposed must be warranted against defects in materials or workmanship, as follows:

1. Three Years Parts / Three Years Labor

a. Fixed CCTV, Hard Disk Drives installed in Network Video Recorders.

2. One Year Parts / One Year Labor

a. Plasma Display Panel, Hard Disk Recorders, Extension Units, Digital Video Disc Recorder (DVD-RAM), Video Network / Transmission Equipment, Software, Lens, and Accessories.

B. Defective products must be repaired or replaced at the discretion on the manufacturer.

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 284613.10 – FIRE ALARM SYSTEM (MODIFY EXISTING)

PART 1 – GENERAL

1.01 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes, but not limited to:

1. Conduit and wiring necessary to connect the existing FACP to alarm initiating devices, notification appliances and auxiliary equipment.
2. Addressable manual fire alarm stations
3. Addressable analog area smoke detectors
4. Addressable analog duct smoke detectors
5. Addressable analog heat detectors
6. Carbon Monoxide Detectors
7. Connections to sprinkler waterflow alarm switches
8. Connections to sprinkler supervisory switches and tamper switches
9. Audible and visual combination notification appliances
10. Air handling systems shutdown relays
11. Elevator recall/shunt relays (if the building has an elevator)
12. Battery standby

C. Work scope:

1. Work shall include any or all of the following:

a. Removal of existing devices no longer required as a result of demolition activities in the project area, as indicated in the Drawings. Demolition work shall include removal of device(s), the removal or surface mounted or exposed backboxes, or the abandonment of recessed backboxes, and removal of any associated wiring, and raceways rendered obsolete by the demolition. It shall also include any programming required to remove such devices from the system. All removed devices shall be turned over to the Owner, unless otherwise noted.

b. Removal and re-installation of existing devices and/or associated wiring to accommodate new finish work or equipment replacements by others.

c. Re-location of existing devices and/or wiring associated with renovated areas. Work shall include all wiring extensions, backboxes as per code and manufacturer specifications to serve the device at its new location.

d. Addition of new devices, backboxes and wiring to serve new or renovated areas as shown on the drawings. Included in this work shall be all programming required to integrate the new devices into the system.

2. It is the declared intent of this specification that the end result of the system modifications shall be a complete and operational fire alarm system. Provide all required expansion modules, power supplies, batteries, interfaces, programming, inspections, testing, etc. to achieve the result whether or not shown on the drawings.

3. Maintain existing fire alarm devices affected by Project Work for renovated space, including areas affected by asbestos abatement within existing zones. This would require disconnection, reconnection and commissioning of existing devices during installation of new ceiling systems.

1.02 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.03 REFERENCES

A. General:

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

2. Unless otherwise noted, the edition of the referenced code or standard that is current at the time of the “date of record” for the Work shall be considered the effective code or standard for the duration of the project.

3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

4. Refer to specific Division 26 Sections for additional referenced codes and standards:

a. ANSI/NFPA 70 - National Electrical Code.
b. ANSI - American National Standards Institute.
c. ASME A17.1 Safety Code for Elevators and Escalators
d. FM - Factory Mutual System.
e. NFPA – National Fire Protection Association
f. NFPA 72 - National Fire Alarm Code
g. UL – Underwriters' Laboratories:

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, provide Manufacturer’s standard catalog sheets, specifications, and installation instructions. Catalog sheets shall be clearly highlighted to show selected models, accessories, options etc.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, riser diagrams and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.

2. Include battery-size calculations for revised service.

3. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

4. Include revised riser diagram complete with devices labeled with Project room numbers and device address number.

5. Include floor plans to indicate final device locations and showing address of each addressable device. In addition, indicate applicable candela settings and tap settings of each notification device.

C. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.

B. Operational Documentation:

1. Program Software Backup: On magnetic media or compact disk, complete with data files and passwords.

2. Device address list.

3. Updated O&M Manual.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.

2. Keys and Tools: One extra set for access to locked and tamper-proofed components.

3. Fuses: Two of each type installed in the system.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.08 WARRANTY

A. Provide and submit written warranty, signed by the manufacturer, agreeing to replace/repair, within the warranty period, all equipment with inadequate and/or defective materials and workmanship, including leakage, breakage, improper assembly or failure to perform as required; provided that the manufacturer's instructions for handling, installing protecting and maintaining units have been adhered to during warranty period. Warranty shall include all component replacement costs, including labor and wring for removal and reinstallation. Such warranty shall be required of the installing contractor even if in excess of original manufacturer warranties.

1. Warranty period: One (1) year, beginning upon completion of equipment installation and commissioning.

1.09 PROJECT CONDITIONS

A. The existing fire alarm system shall remain in service throughout the project, except as described below.

B. Interruptions of Existing Fire Alarm service: Coordinate any required shutdowns with Owner to tie in new fire alarm devices. Outages shall only be scheduled during off hours, weekends, holidays etc. when the building is not in use. Include all premium time on bid. Provide any required fire watches.

1. Notify Architect, Construction Manager, Owner no fewer than two-days in advance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work. The manufacturer's equipment must be listed for use and function with the existing FACP.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices as applicable to the facility:

1. Manual stations.
2. Smoke detectors.
3. Heat Detectors.
4. Beam Detectors.
5. Fire suppression system operation
6. Automatic sprinkler system waterflow device activation.

B. Fire-alarm signal shall initiate the following actions as applicable to the facility. Any operation sent out from the main FACP shall remain as is prior to this project.:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.

3. Send alarm signal to central monitoring station.
4. Release fire and smoke doors held open by magnetic door holders.
5. Shutdown of fans rated 1000cfm or greater.
6. Close smoke dampers in HVAC duct systems.
7. Recall elevator(s) to primary or alternate recall floors.

C. System trouble signal initiation shall be by one or more of the following devices or actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Loss of primary power at fire-alarm control unit.
3. Ground or a single break in fire-alarm control unit internal circuits.
4. Abnormal ac voltage at fire-alarm control unit.
5. Break in standby battery circuitry.
6. Failure of battery charging.
7. Abnormal position of any switch at fire-alarm control unit.
8. Communication loss with any network panel.
9. Amplifier panel loss on voice notification system.
10. Activation of any Carbon Monoxide Detector.

D. System Supervisory signal initiation shall be by one or more of the following devices or actions:

1. Sprinkler Tamper Switch activation.
2. Duct detector activation.
3. Low pressure switch activation on dry pipe sprinkler system.

E. System Trouble and Supervisory Signal Actions: Any operation sent out from the main FACP shall remain as is prior to this project.

1. Annunciate at fire-alarm control unit and remote annunciators. Send trouble / supervisory signal to central monitoring station.

2. For carbon monoxide detector activation – in addition to above, activate local sounder base of the affected device and any associated carbon monoxide notification devices.

2.03 FIRE-ALARM CONTROL UNIT - EXISTING

A. The existing FACP is as shown on the drawings.

B. Fire alarm circuits, subject to compatibility with the existing panel, shall be as follows:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

a. Initiating Device Circuits: Style B.
b. Notification Appliance Circuits: Style Y.
c. Signaling Line Circuits: Style 4.
d. Install no more than 80% addressable devices on each signaling line circuit.

2. Serial Interfaces: Two RS-232 ports for printers.

C. Notification Appliance Circuit operation shall remain as is prior to this project. Operation shall sound in a temporal pattern. All visual notification devices shall be synchronized. Provide NAC Extenders as required.

D. Door hold-open devices that control doors in smoke barrier walls shall be connected to fire-alarm system.

E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

F. Maintain existing automatic transmission of alarm, supervisory, and trouble signals to a remote alarm station.

G. Existing primary power shall remain as is, unless otherwise indicated.

H. Secondary Power: Provide battery calculations to verify if the existing batteries are adequate to meet code requirements after system expansion. Provide additional battery capacity to meet code minimums if required by the addition of new devices.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Station Reset: Key-operated switch.

3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Unless otherwise noted lifting covers shall be non-alarmed. Where alarmed covers are called for, lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation. Provide STI Stopper II or equal.

4. Design Make: Compatible with and listed for use on the existing system.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL-268, operating at 24-V dc, nominal.

2. Detectors shall match and be of the same manufacturer as the existing smoke detectors on the system.

3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL-268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.

4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

6. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.

2.06 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 CARBON MONOXIDE DETECTORS

A. Listed to UL 2075 for Gas and Vapor Detectors and Sensors.

B. The detector shall be equipped with sounder base and trouble relay. The detector base shall be able to mount to a single gang electrical box or direct mount to wall or ceiling.

C. The detector shall provide dual color LED indication which blinks normal, alarm or end-of-life. When sensor supervision is in trouble or end-of-life condition, the detector shall send a trouble signal to the panel. In alarm mode the red LED shall blink in a Temporal 4 pattern and the sounder will sound in in a Temporal 4 pattern.

D. The detector shall provide a means to test CO entry into the CO sensing cell.

E. Operating voltage shall be 12/24 VDC.

2.08 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections. Where used on an existing system containing addressed notification devices, any new devices shall likewise be addressable as well.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

2. Wall mounted notification appliances shall be red color with white lettering. Ceiling mounted notification appliances shall be white color with red lettering.

B. Audible (Horn): Unless otherwise required for compatibility with the existing system: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol. Match existing system devices.

C. Speakers: Unless otherwise required for compatibility with the existing system: High intelligibility across frequency range of 300 to 8000 HZ, 25 or 70 VRMS operation, (5) field selectable taps 1/8 watt up to 2 watts, mountable on 4” square backboxes.

D. Visible Notification Appliances (Strobes): Unless otherwise required for compatibility with the existing system: Xenon strobe lights comply with UL 1971, with clear or nominal white

polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
2. 15/30/75/110 cd, selectable in the field.
3. Mounting: Wall mounted unless otherwise indicated.
4. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
5. Flashing shall be in a temporal pattern, synchronized with other units.
6. Strobe Leads: Factory connected to screw terminals.
7. Mounting Faceplate: Factory finished, red (wall mounted) or white (ceiling mounted
8. Match existing system devices.
9. For visible notification devices associated with carbon monoxide detectors – provide the above with the exception of provide with amber colored lens, and shall have either no engraving or the word " ALERT". In NO case shall the engraving "FIRE" be present in these devices.

E. Combination Horn/Strobe or Speaker Strobe: Shall match the criteria of the individual component devices as described above.

2.09 MAGNETIC DOOR HOLDERS

A. Magnetic door holders shall be UL Listed, flush or surface mounted in a single gang box, aluminum color.

B. Magnetic door holders shall be low voltage, AC or DC and compatible with the existing fire alarm system.

C. Magnetic door holders shall have a holding force of 25lbf and shall hold the door open while energized. Doors shall be released upon power failure, or de-energized by means or fire alarm-controlled relay or other switch.

D. Provide with all required hardware for complete operation – including adjustable contact plates etc.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Supervised IAM: Match existing system device, or provide compatible device listed for use on the system.

2.11 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, notification device, or other device requiring protection.

B. Factory fabricated and furnished by device manufacturer.

C. Finish: Paint of color to match the protected device.

D. Provide device guards to devices installed in areas subject to physical damage. This shall include, but not limited to, Gymnasiums, Wrestling Rooms, Weight Rooms, Locker Rooms, Shops, Receiving / Loading Areas, Exterior devices.

2.12 FIRE ALARM WIRE AND CABLE

A. Fire Alarm circuits: Install cables in metal J hooks above accessible ceilings and in Wiremold 500 exposed in finished spaces.

B. Manufacturers: Subject to fire alarm system manufacturer's requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Comtran Corp.
2. Genesis Cable Products; Honeywell International, Inc.
3. West Penn Wire/CDT; a division of Cable Design Technologies.
4. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

D. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2- hour rating.

E. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multi-conductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.01 FIELD CONDITIONS

A. Prior to installation carefully inspect the installed work of other trades, whether pre-existing or part of this project and verify that such work is complete to the point where the installation of the fire alarm system may properly commence.

3.02 EQUIPMENT INSTALLATION

A. General:

1. Comply with NEC, NFPA 72 and manufacturer requirements or installation of fire-alarm equipment.

2. Prior to performing any work, perform a test of the devices in the work area to confirm existing operational status. Report any non-functional devices to the Owner's Representative for corrective action to be taken, if any, at Owner expense. Devices not functioning after this test shall be considered as Contractor fault and shall be repaired or replaced at Contractor expense.

3. Follow Division 260500 Section "Common Work Results for Electrical", for anchorage requirements.

4. Verify dimensions in the field. Lay out work in the most direct and expeditious manner to avoid interference.

5. Coordinate necessary shutdowns of existing systems by notifying the Construction Manager or Owner's Representative a minimum of 10 working days before rendering such systems inoperative. Do not render inoperative any system without the prior approval.

6. Coordinate fire alarm detectors and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.

7. Coordinate installation of fire alarm system with work of other trades. Protect fire alarm equipment with suitable coverings until completion of Project and remove prior to system turnover.

8. Install initiating devices, control panels, audible signals, connections to equipment provided under other divisions, and related work following equipment manufacturers' requirements for a complete and properly functioning system that will perform specified functions.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Devices and raceways installed in new walls or existing stud walls shall be flush mounted with concealed wiring. Devices installed on existing block wall construction shall be surface mounted.

D. Smoke-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.

2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

3. Smooth ceiling spacing shall not exceed 30 feet. Greater spacing in corridors in accordance with NFPA 72 is permitted.

4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.

5. Locate ceiling mounted detectors not less than 4" from any wall.

6. Locate wall mounted smoke detectors not more than 12" from the ceiling.

7. Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

8. Locate detectors not closer than 12 inches from any part of a lighting fixture.

E. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of duct.

F. Fire Alarm manual pull stations shall be mounted no less than 42" and not more than 48" above finished floor to the operable part.

G. Visible Alarm-Indicating Devices shall be installed with the lens at no less than 80” and not more than 96” above finished floor or on the ceiling as indicated. Install all devices at the same height unless otherwise indicated.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.03 PATHWAYS

A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed. Support from “j-hooks” or wiring bridles secured to structural members. Fire alarm wiring shall not be supported by the ceiling grid.

B. Exposed pathways located in finished areas shall be installed in surface metal raceway and in EMT in storage, mechanical and utility spaces.

C. Exposed EMT shall be painted to match adjacent areas.

D. Exposed box covers in non-public areas shall be painted red.

3.04 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

3.06 INTEGRATION

A. New Devices: Perform all required programming to enroll new points into the fire alarm system programming.

B. Removed Devices: Perform all required programming to delete all permanently removed points from the fire alarm system programming.

C. Relocated Devices: Perform all required programming required to relabel alarm points affected by building renovations and re-configurations.

3.07 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction (AHJ).

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. Coordinate and obtain any inspections required by the Authority Having Jurisdiction to obtain certificate of occupancy. Include any fees in bid.

3. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

4. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

5. Test audible appliances for the private operating mode according to manufacturer's written instructions.

6. Test visible appliances for the public operating mode according to manufacturer's written instructions.

7. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 310000 – EARTHWORK

PART 1 - GENERAL

1.01 GENERAL

A. Applicable provisions of the "Conditions of the Contract" shall govern all work under this section.

B. Contractor must observe and adhere to New York Code, 6 NYCRR, Chapter IV and all applicable Subchapters and Parts for the receipt of, or removal, transport, tracking and disposal of all soils and construction waste and debris, as enforced by the New York State Department of Environmental Conservation. All fees associated with testing of materials and debris either at the point of origin (site) or point of termination, are to be borne by the Contractor.

C. Related Documents:

1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and sections in Division 01 of these Specifications.
2. Section 033000 – Cast-In-Place Concrete
3. Section 310001 – Site Work General Provisions
4. Section 312500 – Erosion and Sediment Controls
5. Section 320117 – Pavement Repair and Resurfacing
6. Section 321216 – Asphalt Paving
7. Section 321216.11 – Asphalt Overlay
8. Section 334000 – Storm Drainage Utilities
9. Other Division 31, 32 & 33 Sections related to the work of the Contract as applicable.

1.02 SCOPE/SUMMARY

A. Provide all labor, materials, equipment, and services and perform all operations required to complete the installation of all work of this section and related work as indicated on the drawings and specified herein, including, but not limited to, the following:

1. Erect and maintain barriers in accordance with all local municipal and state requirements.

2. Remove all obstructions in the way of new construction work which may be required in addition to clearing and removal work specified under Section 310001 – Site Work General Provisions.

3. Excavation and preparation of sub grade for building slabs, floor slabs, depressions and pits, foundations, interior and exterior column footings, walks, stairs, ramps, and pavements. All other excavation which may be required to complete the work and is not specified under other sections.

4. Shoring, sheathing, and pumping.

5. Backfilling all work within building lines to the required grades.

6. Granular fill course for support building slabs is included as part of this work.

7. Excavating and backfilling of trenches within building lines.

8. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances, transformer pads, and conduits for same, underfloor

utility lines, etc. inside or outside of the building footprint.

9. Filling and grading.

10. Finish grading of sub grade.

11. Finished grades.

B. Final grading, together with placement and preparation of topsoil for lawns and planting, is specified elsewhere in Division 32 - Exterior Improvements.

1.03 DEFINITIONS

A. Excavation consists of removal of material encountered to subgrade elevations indicated or required by the work and subsequent disposal of materials removed. Materials to be excavated shall be non-classified and shall include all rock, earth, or other materials encountered in excavating and grading operations for building or site work. The contract price covers the removal of all such materials to the depth and extent indicated on the drawings specified herein or as required to perform the work.

B. Unauthorized excavation consists of removal of materials beyond required sub grade elevations or dimensions without specific direction of the Soils Engineer. Unauthorized excavation, as well as remedial work directed by the Soils Engineer, shall be at the Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation with compacted controlled structural fill material or by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.

2. In locations other that those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Construction Manager (when applicable), Architect or the Soils Engineer.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify the Architect/Engineer, who will make an inspection of conditions. If Architect/Engineer (based upon Soils Engineer's reports) determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by the Soils Engineer.

1. Removal of unidentified unsuitable materials and its replacement beyond the limits required for the construction work as directed will be paid on basis of Conditions of the Contract relative to changes in the work.

D. Sub grade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Fill is that material removed from excavations or imported from off site borrow areas, predominantly granular, non-expansive soils free from roots and other deleterious matter. Fill material is subject to approval.

F. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.04 SUBMITTALS

A. Test Reports: The Contractor shall submit the following reports directly to the Construction Manager (if applicable), the Owner, and the Architect:

1. Test reports on borrow material.

2. Verification of suitability of each footing subgrade material, in accordance with specified requirements including substantiation of and structural capacity of existing rock on which new footings are to bear.

3. Field reports; in-place soil density tests.

4. One optimum moisture-maximum density curve for each type of soil encountered.

5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

C. Use equipment adequate in size, capacity, and numbers to accomplish the work of this section in a timely manner.

D. Engineering, Testing, and Inspection Services: The Contractor shall make arrangements for and the Owner shall pay for a qualified independent geotechnical testing laboratory and associated soil engineer (acceptable to the Owner) to perform soil survey and soil testing service for sampling and testing of materials proposed to be used as well as substantiation and verification of existing subsurface conditions when desired depths of excavation are reached. The Contractor will be responsible for all costs associated with failed tests resulting from their work.

E. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory and associated soils engineer must demonstrate to the Owner's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the work.

1.06 SOILS ENGINEER (SERVICES AS EMPLOYED AND PAID BY THE OWNER)

A. For site conditions without complex soil problems, a registered soils engineer shall be engaged to perform the following minimum services:

1. Examine on-site materials to determine suitability for use.

2. Recommend locations for placing on-site materials.

3. Recommendations for compacting on-site materials.

4. Determine suitability of soil under footings, foundations.

5. Perform compaction tests and supervise filling operations.

B. Soils engineer's services for problem site conditions shall include the above and the following additional work at minimum:

1. Determine extent of unsuitable material removal.

2. Testing of materials proposed for use from off-site and on-site sources.

3. Dewatering recommendations.

4. Supervising the placing and compacting of approved materials and under footings, foundations, slabs, utility lines, and paved areas.

5. Supervising environmental protection procedures as required by Federal, State, and Municipal Agencies.

   NOTE: Copies of soils reports prepared by soils engineer are to be sent to the Owner, the Architect, and Construction Manager (if applicable).

1.07 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports were used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Construction Manager, The Architect, and the Owner will not be responsible for interpretations or conclusions drawn from these data by the Contractor.

   1. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Examine the areas and conditions under which the work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

C. Set all lines, elevations, and grades for utility and drainage system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

D. Existing Utilities: Locate existing underground utilities in areas of excavation work. This work to be substantiated and paid by this Contractor. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations. If damaged, repair or replace at no additional cost to the Owner.

   1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with the Owner, the Construction Manager (if applicable) and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

   2. Do not interrupt existing utilities service facilities occupied by the School or others, during occupied hours, except when permitted in writing by Architect/Engineer and then only after acceptable temporary utility services have been provided.

   3. Provide minimum 48-hour notice to the Construction Manager (when applicable), Architect, and Owner, and receive written notice to proceed before interrupting any utility.

   4. If service is interrupted as a result of work under this section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

5. If existing utilities are found to interfere with the permanent facilities being constructed under this section, immediately notify the Architect and secure his instructions.

6. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

E. Use of Explosives: Use of explosives is permitted for certain types of rock removal only but that use must be substantiated with the Owner, Architect/Engineer, State, and Local Agencies prior to bidding and again prior to commencement of work.

1. The use of explosives is only permitted when the Owner has been notified of same by written notice of the Contractor through Architect/Engineer, thereby permitting the Owner and its surrounding neighbors the required legal notices to vacate and/or protect their properties, buildings, homes, or premises as needed.

F. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

3. Provide all protective measures necessary for the safety of workmen. The above shall be carried out in accordance with and in compliance with regulations of local, county, federal, and OSHA authorities having jurisdiction over same. Protection is entirely the responsibility of the Contractor.

4. The work shall be executed so that no damage or injury will occur to the Owner's property or building, to public and adjoining or adjacent structures, streets, paving, sewers, gas, water, electric, or any other pipes. Should any damage or injury caused by the Contractor or anyone in his employ, or by the work under this Contract occur, the Contractor shall, at his expense, make good such damage and assume all responsibility for such injury.

5. The above shall also include the protection of all existing sewers and drainage systems to remain in use within the area affected by the work of this project.

6. Monuments, benchmarks, and other reference features on streets bounding this project shall be protected. Should these be disturbed in any manner, the Contractor shall have them replaced.

7. Use every means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

8. Maintain access to adjacent areas at all times.

G. The Contractor is to acquaint himself with the existence and location of all surface and subsurface structures and utilities within the project area. He is not to damage any of those that are to remain, and he is to leave them accessible and make the necessary provisions by sheeting, hanging, supporting, or other means necessary to obtain this result, subject to the approval of Architect/Engineer, the local municipality, the utility company involved, and any other agencies having jurisdiction over this project.

H. Prior to entering his bid, the Contractor shall visit the site and familiarize himself with all existing conditions. All nearby existing buildings and utilities shall be inspected by the Contractor prior to

entering his bid.

I. Borings were prepared by others, and provided by the Owner. The Geotechnical Report contained herein shall be reviewed prior to bid. The documents are for information only. Contractor shall interpret for themselves the soil condition underlying the surface of the ground.

J. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups CG, SC, ML, MH, CL, CH, OL, OH, and PT.

C. Granular Fill: Naturally or artificially graded mixture or natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand meeting requirements for New York State Department of Transportation Standard Specification 304.2.02, Type 4 unless otherwise indicated.

D. Subbase Material: Graded mixture of crushed rock, with 100 percent passing a 2-inch sieve and meeting requirements for New York State Department of Transportation Standard Specification 3.04-2.02, Type 2, unless otherwise indicated.

E. Backfill and Fill Materials: Satisfactory non-expansive soil materials free of organic material, roots, other deleterious substances, clay, rock or gravel larger than 2 inches in any dimension, debris, waste and frozen materials.

2.02 CONTROLLED STRUCTURAL FILL OR MATERIAL

A. Imported controlled structural fill shall consist of inert material that is hard, durable stone and coarse sand, practically free from silts, clay, frozen sections, and foreign substances. It may consist of either natural or washed soil and must be free of organics. The material shall be a well graded mixture, shall have no material larger than 4", and must have the following gradations by weight:

Maximum retained on 3/4-inch sieve:	30%.
Maximum retained on No. 4 sieve:	50%.
Maximum passing 100 sieve:	25%.
Maximum passing 200 sieve:	5%.

This grading shall be determined in accordance with ASTM Standard Specification C117 and C136.

2.03 SUB BASE FILL OR MATERIAL

A. Sub base fill shall consist of inert material that is clean, hard, durable stone, sand, and non-plastic silt completely free from clays, frozen sections, and foreign substances. It may consist of either natural or washed soil and must be free of organics. The sub base fill shall be a well graded mixture, shall have material not larger than 2 inches, and must comply with the following grain size gradation by weight:

Maximum passing No. 100 sieve: 35%.
Maximum passing No. 200 sieve: 25%.

This grading shall be determined in accordance with ASTM Standard Specification C117 and C136.

2.04 WEED KILLER

A. Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting growth of vegetation, and approved for use on this work by governmental agencies having jurisdiction.

2.05 TOPSOIL

A. Where and if shown on the drawings or otherwise required, provide topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones, noxious weeds, sticks, brush, litter, and other deleterious matter.

B. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained from sources outside the project limits, or from both sources. Stockpiled topsoil may be used, provided it meets the requirements of these specifications. Additional topsoil from certified off-site sources shall be used, provided it meets the requirements of these specifications. Topsoil for lawn and planting operations shall be fertile, friable, natural loam containing a liberal amount of humus. It shall be free of admixtures and subsoil and shall be reasonably free of noxious weed, seed, lumps, plants, or their roots, and completely free of stones, sticks, and other extraneous matter, and shall not be used for planting operations while in a frozen or muddy condition. After spreading to a uniform depth of 6” minimum, all topsoil shall be raked to remove all extraneous matter. Raked topsoil shall conform to the mechanical analysis specified below and shall be free of stones, lumps, plants or their roots, sticks and similar debris, or any other undesirable material. Topsoil shall not be used in a muddy or frozen condition.

1. All topsoil to be furnished shall be subject to the approval of the Architect. Furnish a certified analysis, made by a recognized authority, of any topsoil that may have to be furnished to complete the work of this section. Test reports shall match the format listed below.

2. Topsoil shall have an acidity range of pH 5.0 to 7.0 and shall contain not less than 6 percent organic matter as determined by loss on ignition of moisture-free samples dried at 100 degrees centigrade. The mechanical analysis of the soil shall be as follows:

Passing	Retained On	Percentage
1" screen		100%
1" screen	¼" screen (gravel)	Not more than 3%
¼" screen	No. 100 USS mesh sieve (sand)	40%-60%
#100 USS	(Very fine sand, silt & clay)	40%-60%

3. Topsoil in which more than 60 percent of the material passing the USS No. 100 mesh sieve consists of clay as determined by the hydrometer or by the decantation method, shall not be used. All percentages are to be based on dry weight samples. The chemical and mechanical analysis shall state the above items in correct quantities.

4. The Architect reserves the right to take samples of the topsoil from time to time, whether delivered to or stored at the site. These samples will be analyzed for comparison with the Specifications. Should tests show that topsoil does not comply with the Specifications, the material may be rejected or such other remedy made as approved by the Architect in the form of the addition of humus or other supplemental materials.

5. The topsoil mixture materials shall be thoroughly mixed by hand or by rotary mixer to the satisfaction of the Architect.

2.06 OTHER MATERIALS

A. Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation Classifications: The following classifications of excavation will be made when rock is encountered:

1. Earth Excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

2. Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator, equivalent to Caterpillar Model No. 215C LC, and rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity.

3. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.

4. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered that cannot be dislodged and excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or equivalent track-mounted loader, rated at not less than 210 HP flywheel power and developing minimum of 45,000 pound breakout force (measured in accordance with SAE J732).

    a. Typical materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
    b. Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

5. Rock Excavation:

    a. In the event that rock is encountered and is of a type that cannot be broken up and excavated by machine or moved into deep fill areas, blast as necessary, and remove and dispose of same off site.

    b. Rock that can be broken up, excavated by machine, and/or moved into deep fill areas shall be reduced to a size not exceeding 6" prior to depositing in deep fill areas.

    c. Definition: Whenever the word "removal" is used in connection with rock, it is to be construed to mean "blasting, excavating, and the removal of rock that cannot be broken up by machine and removed", as defined previously.

        1) As this facility is in session daily Monday through Friday and its surrounding neighbors

are contiguous, the preferred methodology of excavation and removal of rock is to be construed as "passive" in nature--meaning "drilling or any other passive means". The excavation contractor shall coordinate his/her work with the Owner's representative so as to perform that work with the least disruption to the Owner and the Owner's neighbors and with maximum intent to the safety of same. The preferred time of rock removal work shall take place when the Owner's facilities are vacated, thereby meaning after the close of school each day or on weekends, as long as these times are permitted by all State and Local Ordinances and are acceptable and coordinated with the School and its neighbors.

d. Blasting shall conform strictly to all local and state laws, rules, and regulations applying thereto, and shall avoid excess noise and vibration. Steel mats shall be provided where necessary to prevent damage from flying fragments. Drill holes shall not be carried any further than necessary to remove the rock desired. The care, handling, and storing of explosives shall conform strictly to all local and state laws, rules, and regulations applying thereto. After concrete is set in place, no blasting shall be done except with the written permission of the Owner, and Architect.

e. The Contractor may consider the utilization of "Super Bristar 2000", a non-explosive demolition agent as a means of rock removal for this project.

f. General:

    1) Blasting shall be done as necessary for breaking rock for removal to depths, limits, and extent required for the construction of the building, site grading, and utility lines.

    2) Blasting shall be performed only by experienced, competent, licensed personnel under the direct supervision of an experienced, competent, licensed foreman.

g. Precautions:

    1) Blasting shall be permitted only when proper and adequate precautions have been taken for the protection of personnel, work, and property.

    2) Caps, fuses, and other exploders shall in no case be stored in the same place in which explosives are stored.

    3) All operations involving delivery, handling, storage, and the use of explosives shall be conducted in accordance with applicable laws, statutes, and regulations of the State, Municipal, or other governing bodies having jurisdiction. Likewise, the blasting contractor shall secure and pay for all necessary permits on behalf of the excavation contractor/contractor and shall provide same to the Owner, and Architect prior to scheduling the work. Open rock and rock in trenches shall be removed to a depth of 8" below required grades.

h. Do not perform rock excavation work until material to be excavated has been cross sectioned and classified by the Contractor's qualified independent geotechnical testing laboratory and associated soils engineer (employed and paid by the Contractor), and as approved by Architect/Engineer.

i. Rock payment lines are limited to the following:

    1) Three feet outside of concrete work for which forms are required, except footings.

    2) Two feet outside perimeter of footings.

3) In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width.

4) Outside dimensions of concrete work where no forms are required.

5) To bottom of all footings which, as designed, are minimum 1'-8" below finished floor and are to bear on undisturbed rock of 8 T.S.F. bearing capacity minimum. This capacity to be verified by Contractor's geotechnical testing laboratory and associated soils engineer.

6) Under slabs on grade, 6 inches below bottom of concrete slab.

7) Work indicated herein under these rock payment lines is part of this Contractor's base bid.

3.02 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. The Contractor shall safely support and maintain adjacent and abutting property and structures and shall maintain the work safe to life, limb, and property.

C. Barriers, sheet piling, bracing, and the like shall be installed where required to maintain the excavation and the banks in a safe and stable condition.

D. Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen is required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

E. Slope sides of excavations to 1:1 or flatter or to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

F. Shoring and bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

G. All temporary sheet piling, bracing, shoring, and other protective work shall be removed after the necessity for same ceases to exist, in the opinion of the Architect, and before backfilling.

H. All work removed or damaged through the installation or removal of the temporary protective work or through improper protection work shall be replaced or repaired in an approved manner at no cost to the Owner.

I. Maintain excavations free from detrimental quantities of leaves, sticks, trash, and other debris until completion of the work.

3.03 DEWATERING

A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and

discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

B. Surrounding soil shall not be disturbed or removed during pumping operations.

C. Water shall be disposed of by pumping to a point directed by the Architect without damage to adjacent property.

D. The Contractor shall provide, operate, and maintain adequate equipment to keep the excavations free from water so that the excavating, concrete work, membrane waterproofing, and all other work in the excavations will be performed in the dry.

E. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

3.04 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.05 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

B. Contractor shall prepare building and sidewalk areas to underside of floor slab plus or minus 1/2". Under no circumstances shall any material other than approved on-site material, or specified imported controlled structural fill be used for filling within a depth of 10" inches below building and sidewalk slabs on grade or within a depth of 12" beneath all column or wall support footings. Imported controlled structural fill shall also be utilized in all areas supporting earthen or other load carrying structures where organic soil materials are encountered subsequent to the removal of said organic soil materials.

C. Excavations for footings and foundations: Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work. Piers, concrete slabs, and footings shall be benched a minimum of 2" into rock at sloping rock conditions as indicated on the drawings where no excavation is required.

D. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction, and for inspection. Do not disturb bottom of excavations intended for bearing surface.

E. Unsuitable Material: All unsuitable material below the grading plane shall be excavated and removed and the space filled with granular material as specified herein.

1. Unsuitable materials are those soils that exhibit characteristics that make them unsuitable for the direct support of the pavement structure, such as organic silt, elastic clays and silts, topsoil, frost susceptible soils, etc. Unsuitable materials shall be removed to the depth directed by the Soils Engineer and the Construction Manager when applicable.

2. The excavation and disposal of unidentified unsuitable material below the grading plane shall be paid on the basis of the Conditions of the Contract relative to Changes in the Work.

3. The granular fill material will be used in the fill sections within the paving area. No additional payment will be made for placing this material in the fill areas.

F. Unsuitable material will be legally disposed of off site.

3.06 EXCAVATION FOR PAVEMENTS, SLOPES, DITCHES, ETC.

A. The work under this item shall consist of the following in accordance with the plans, specifications, addenda, bid proposal, and requirements herein: excavating for pavement, slopes, ditches, and all other work incidental to the excavation for the pavement, including disposing of unsuitable and surplus material, preparing the subgrade, compaction, grading, slopes and shoulders, and all other work needed to complete the item.

B. Cut surface under pavements to comply with cross sections, elevations, and grades as indicated.

C. Drainage and Site Maintenance: During construction, the site shall be maintained in such condition that it will be adequately drained at all times.

D. Unsuitable Material: All unsuitable material below the grading plane shall be excavated and removed and the space filled with granular material as specified herein.

1. Unsuitable materials are those soils that exhibit characteristics that make them unsuitable for the direct support of the pavement structure, such as organic silt, elastic clays and silts, topsoil, frost susceptible soils, etc. Unsuitable materials shall be removed to the depth directed by the Soils Engineer and the Construction Manager when applicable.

2. The excavation and disposal of unidentified unsuitable material below the grading plane shall be paid on the basis of the Conditions of the Contract relative to Changes in the Work.

3. The granular fill material will be used in the fill sections within the paving area. No additional payment will be made for placing this material in the fill areas.

E. Unsuitable material will be legally disposed of off site.

F. The Contractor shall store topsoil, embankment soils, and other materials, and/or to excavate beyond the limits of the contract and slope easements. The cost of stockpiling and rehandling shall be included in his base bid price.

G. All soils that are classed as suitable for the direct support of the pavement (non-organic and non-frost susceptible soils) shall be scarified to a loose depth of ten (10) inches and recompacted to 95% of the maximum density at the optimum moisture content of the soils determined by ASTM D-1557. The moisture content at the time of compaction shall not be greater than one (1) percent nor less than two (2) percent by weight of dry soil of the optimum moisture content. Dry soils shall be moistened and thoroughly mixed to the required moisture content. Wet soils shall be dried by aerating the required moisture content.

1. The cost of adding moisture, drying, and compaction shall be included in the Contractor's base

bid price.

H. Subgrade in excavated areas for new pavement shall be compacted to the density specified below. Soils not conforming to this density shall be scarified or loosened to a depth of ten (10) inches, water added in the amount necessary, and the material recompacted to provide the required density.

1. Compaction control will be provided as follows: The subgrade in excavated areas shall be compacted to at least ninety-five (95) percent of the maximum density as determined by the "Test for Moisture Density Relations of Soils using a 10 lb. Rammer and 18 inch Drop", ASTM D-1557 as currently revised. Samples of subgrade materials for testing purposed shall be taken at frequent intervals daily. From these tests, corrections and changes in moisture content will be made and compaction continued until required densities are achieved.

I. The Contractor shall check the work under this Item with templates, slope boards, or other devices satisfactory to the Soils Engineer. The completed work shall conform to the plans within the following tolerances.

J. For pavement subgrade, the surface shall vary no more than three-quarter (¾) inch from a ten (10) foot straight edge applied to the surface, and the actual grade of the subgrade shall not vary more than one (1) inch from plan elevation.

3.07 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficient wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both side of pipe or conduit.

B. Accurately cut trenches for pipe or conduit that is to be installed to designed elevations and grades to line and grade from 4" below bottom of pipe and to width as specified. Place 4" of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 6" layers measured loose to the top of the trench.

C. Excavate trenches and conduit to a depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost lines.

1. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.

2. For pipes or conduit less than 6" in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

3. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90° (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensuring continuous bearing of pipe barrel on bearing surface.

4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects.

5. When the void is below the sub-grade for the utility bedding, use suitable earth materials and compact to the relative density of 95 percent (in accordance with ASTM D698).

6. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated to a relative density of 92 percent (in accordance with ASTM D1557).

7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.

D. The local utility companies shall be contacted before excavation shall begin. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous uniform bedding.

E. All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheeted, braced, or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to an exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

F. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

G. Trench width requirements below the top of the pipe shall not be less than 12" nor more than 18" wider than outside surface of any pipe or conduit that is to be installed to designated elevations and grades. All other trench width requirements for pipe, conduit, or cable shall be at least practical width that will allow for proper compaction of trench backfill.

H. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances:

1. Water mains: 50" to top of pipe barrel.

2. Sanitary Sewer: Elevations and grades as indicated on drawings (48" minimum cover).

3. Storm Sewer: Depths, elevations, and grades as shown on drawings.

4. Electrical Conduits: 30" minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or the local utility company requirements, whichever is deeper.

5. TV Conduits: 18" minimum to top of conduit or as required by the local utility company, whichever is deeper.

6. Telephone Conduits: 30" minimum to top of conduit, or as required by the local utility company, whichever is deeper.

7. Gas Mains and Service: 30" minimum to top of pipe, or as required by the local utility company, whichever is deeper.

8. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long-radius rigid metal conduit riser, provided it will not interfere with the structural integrity of the slab or pavement.

9. Where the minimum cover is not provided, encase the pipes in concrete as indicated. Provide concrete with a minimum 28-day compressive strength of 2,500 psi.

I. Excavating for Appurtenances:

1. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.

2. Over-depth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete at no additional cost to the Owner.

3. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.

3.08 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

3.09 BACKFILL AND FILL

A. All excavations shall be backfilled as promptly as the work permits but not before concrete has attained its full design strength and not until completion of the following:

1. Acceptance of construction below finish grade, including, where applicable, damp-proofing and water-proofing.

2. Inspecting, testing, approving, and recording locations of underground utilities.

3. Removing concrete formwork.

4. Removing shoring and bracing, and backfilling of voids with satisfactory materials.

5. Removing trash and debris within excavated areas.

6. Placement of horizontal bracing on horizontally supported walls.

B. No frozen material shall be used. Backfill shall be placed in uniform horizontal layers of approximately 8" in depth. Each layer shall be moistened during compaction. Compaction shall be done in a manner approved by the Architect and shall be continued until fill is solid and no settlement will occur.

C. When sheeting, shoring, and bracing is removed, all voids shall be filled with sound materials and thoroughly tamped.

D. Backfill operations shall be made to the new surface grades as shown on the drawings.

E. No backfill shall be placed covering other work until after such work has been inspected and approved. Any backfilling placed on earth that has caved in and covered other work before same has been inspected and approved shall be removed when so directed.

F. Excess material, if any, and all rubbish shall be removed from the site or otherwise disposed of as may be directed by the Architect.

G. General: Place soil material in layers to required subgrade elevations, for each area classification

listed below, using materials specified herein.

1. Under grassed areas, use satisfactory excavated or borrow material.

2. Under walk sand pavements, use subbase material.

3. Under steps, use subbase material.

4. Under foundations, use controlled structural fill material.

5. Under building slabs, use granular material or on site sub grade material if determined acceptable by the Architect or Soils Engineer.

6. Under piping, conduit, and equipment, use subbase materials where required over rock bearing surface unless otherwise indicated. Shape excavation bottom to fit bottom 90° of cylinder.

3.10 CONTROLLED STRUCTURAL FILL OR MATERIAL

A. Location: Imported controlled structural fill shall be used when necessary to provide proper soil bearing capacity:

1. Under all proposed buildings and sidewalks and at least 5 feet beyond the limits of the proposed buildings to a depth as required by foundation design where sidewalks are not part of the scope of building work.

2. Under all footings (continuous or spread) to a depth of at least 12 inches, or as required by foundation design.

3. For all load carrying structures which are situated in areas of soft organic soil deposits subsequent to the removal of said soft organic soil deposits.

4. Sand shall be used as bedding for all drainage and sewerage utilities, unless groundwater problems are encountered or anticipated that may require the use of crushed stone.

3.11 SUB BASE FILL OR MATERIAL

A. Location: The subbase fill may be used in all fill areas where controlled structural fills specified for buildings are not required due to soil conditions, as long as the requirements listed in Section 2.03A are met. Under no circumstances shall subbase material be in directed contact with structural support component, or in support of any of the proposed utilities.

B. Backfill trenches with concrete where trench excavations pass with 18" of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

1. Concrete is specified in Division 03.

2. Do not backfill trenches until test and inspections have been made and backfilling is authorized by Contracting Officer. Use care in backfilling to avoid damage or displacement of pipe systems.

C. Provide 4" thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

D. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Inspection testing, approval, and recording locations of underground utilities have been performed and recorded.

3. Removal of concrete formwork.

4. Removal of shoring and bracing and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.

5. Removal of trash and debris from excavation.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.12 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

B. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structure, piping or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Where the construction includes basement or other underground walls having structural floors over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.

F. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed if soil density test indicate inadequate compaction.

1. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density, in accordance with ASTM D 1557 (Modified Proctor):

a. Under footings, compact subgrade and subbase material to at least 95% maximum dry density.

b. Under structures, building slabs and steps, and pavements, compact top 12” of subgrade and each layer of backfill or fill material to at least 95% maximum dry density.

c. Under lawn or unpaved areas, compact top 6" of subgrade and each layer of backfill or fill material to a MAXIMUM of 85% maximum dry density.

d. Under synthetic turf, compact top 6" of subgrade and each layer of backfill or fill material to at least 90% maximum dry density.

e. Under walkways, compact top 6" of subgrade and each layer of backfill or fill material to at least 95% maximum dry density.

G. Moisture Control:

1. Where subgrade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface during or subsequent to compacting operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.

3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests.

3.13 FILLING AND BACKFILLING

A. Filling and backfilling work shall include, but is not limited to, the following:

1. Contractor shall place and compact bank-run sand and gravel from approved imported sources consisting of clean bank-run gravel or sandy gravel, free from organic material, loam, wood, trash, snow, ice, and other objectionable material, well graded within the following limits:

Maximum retained on 3/4" sieve:	30%.
Maximum retained on No. 4 sieve:	50%.
Maximum passing 100 sieve:	25-30%.
Maximum passing 200 sieve:	5%.

No material larger than 2-1/2" to 4" sieve size by weight. When available, on-site material may be used in place of imported controlled structural fill with the Soils Engineer's approval.

2. Compaction of bank-run gravel under footings, foundation, under slabs on grade, and in building areas shall be to 95% of maximum density in accordance with ASTM Test Designation D1557.

3. Granular material where required under footings and foundations shall conform to material and gradations previously specified and shall be determined in accordance with ASTM Standard Specifications C117 and C136.

4. Filling--Imported Controlled Structural Fill: Compaction of the controlled imported structural fill shall be performed at a moisture content 3% drier than optimum as determined in the lab. It shall be placed in uniform layers not exceeding 10 and/or 12 inches thick after compaction. Each lift shall be compacted to not less than 95% of the maximum dry density determined within the lab as modified proctor density and shall be monitored by the soils engineer using the applicable ASTM standard for testing. Each lift shall have a minimum of 2 feet density test per 500 square yards, one located in the area of the propose column and the second located

under a continuous wall footing. More frequent testing may be required at the discretion of the Soils Engineer based on the extent of filling on any given day or should any area become suspect.

5. Filling--Subbase Fill: Compaction of all subbase fill, either imported or on-site, shall be compacted at a moisture content 1-1.5% drier than optimum as determined in the lab. The subbase fill shall be placed in uniform layers not exceeding 8 inches in depth when uncompacted. Each lift shall be compacted to not less than 95% of its maximum dry density determined in the lab as modified standard for testing. At least two field density test shall be performed per lift within the area being filled on any given day beneath buildings provided the lift areas do not exceed 500 square yards.

3.14 TRENCH BACKFILLING

A. Criteria: Trenches shall not be backfilled until required tests are performed and the utility systems comply with and are accepted by applicable governing authorities. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified, to properly correct condition in an acceptable manner.

B. Backfilling: After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in 8" maximum loose lifts. Compact to minimum density of 95 percent of optimum density in accordance with ASTM D698 (or 92 percent of optimum density in accordance with ASTM D1557).

C. Compaction: Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Compaction Testing: Independent testing laboratory shall perform test at intervals not exceeding 200'-0" of trench for the first and every other 8" lift of compacted trench backfill and furnish copies of test results as specified.

3.15 MATERIALS FOR FILL UNDER CONCRETE SLABS ON GRADE

A. Contractor is to establish building pad at underside of floor slab, plus or minus 1/2".

B. Prior to placing fill fine grading materials on building pad, existing pad fill shall be leveled and recompacted.

C. Fill materials under concrete slabs on-grade in building areas, under sidewalks, pads, concrete aprons, etc., are to be the sieve analysis previously shown for controlled structural fill.

D. Compaction of fill shall be as previously set forth. When compacting fill with mechanical compactor against foundation walls, pits, loading dock, etc., Contractor shall provide complete protection against damage to said installations.

E. There is to be a layer of no less than 6" of clean suitable bank run sand fill below all slabs on grade. On site material may be acceptable and its usability is to be verified via soils reports. The Contractor’s bid is to be based on the use of on site material for use under slabs unless indicated otherwise within the Construction Documents.

F. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum, quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction

to specified density.

2. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.16 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

2. Walks: Shape surface of areas under walks to line, grade, and cross section, with finish surface not more than 1/2" above or below required subgrade elevation.

3. Shape the surface or areas scheduled to be under pavement to line, grade, and cross section, with finished surface not more than 0.05 feet above or below the required subgrade elevation.

C. Grading Surface or Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10-foot straight edge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.17 PAVEMENT SUB BASE COURSE

A. General: Subbase course consist of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

1. Refer to other Division 32 sections for paving specifications.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12-inch width of shoulder simultaneously with the compaction and rolling of each layer of subbase course.

D. Placing: Place sub base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

1. When a compacted subbase course is indicated to be 6" thick or less, place material in a single layer. When indicated to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.18 FOOTING AND BUILDING SLAB SUB BASE COURSE

A. General: Subbase course consists of placement of subbase material, in layers of indicated thickness, over subgrade surface and/or granular fill to support concrete building slabs as indicated on drawings.

B. Placing: Place material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. When a compacted subbase course is indicated to be 6" thick or less, place material in a single layer. When indicated to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.19 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service and the Construction Manager (when applicable) to inspect and approve each subgrade and fill layer before further backfill and construction work is performed.

1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ATM D 2167 (rubber balloon method), as applicable.

2. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gauges in accordance with ASTM D3017.

    a. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work, on each different type of material encountered, and at intervals as directed by the Contracting Officer.

3. Footing Subgrade: Per each stratum of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested stratum when acceptable to the Construction Manager (if applicable) and the Architect.

4. Paved Areas and Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.

5. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.

6. If it is determined by the Construction Manager (if applicable), the Architect, the Owner, and/or Independent geotechnical testing laboratory and associated soils engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.20 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction or if the project is of sufficient size to require one, refer to the Storm Water Prevention and Protection Plan included elsewhere herein.

3.21 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 CERTIFICATION

A. Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Architect a written report from a soil engineer certifying that the compaction requirements have been obtained and the type or classification of fill material placed.

3.23 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. All rubbish and other excavated material, which in the opinion of the Architect is not suitable for fill or grading, shall be removed and legally disposed of away from the premises.

B. Approved excavated material shall be spread on the site in locations as directed by the Architect.

C. Excavated material in excess of that required for all filling, backfilling, and rough grading shall become the property of the Contractor and shall be removed from the premises and legally disposed of.

D. Removal from the School's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off the School's property.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 310001 – SITE WORK GENERAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL:

A. Applicable provisions of the “Conditions of the Contract” shall govern the work of this section and under Division 31, 32 & 33.

1.02 SCOPE/SUMMARY:

A. The Drawings and Specifications are intended to provide for a complete and ready for operation installation. However, both the Drawings and Specifications are for the Contractor's guidance and are not intended to give every detail of the existing conditions or new installations nor do they describe every fitting required for the installation of the work. The Contractor shall furnish, install, and place in workmanlike manner all equipment, accessories, supports, fittings, and all other material needed for the complete installation.

B. Before submitting his proposal, the Contractor shall be fully informed to the extent, character and intent of the work to be done by him. No consideration will be granted for any misunderstanding of the material to be furnished or work to be performed.

C. The site work scope shall include providing all plant facilities, labor, materials, tools, equipment, appliances and supervision necessary or incidental to complete site work, including, but not limited to, the following:

1. Surveying and layout work
2. Preliminary work
3. Demolition
4. Clearing and grubbing
5. Striping and stockpiling existing topsoil
6. Protection
7. Removal and disposal
8. Rough grading, excavating, filling, backfilling and dewatering
9. Excavating, trenching, and backfilling for utility systems including gas, water, electric, telephone, storm and sanitary lines.
10. Sediment and erosion control procedures as may be required.
11. Storm water drainage systems, catch basins and manholes
12. Site improvements, including but not limited to, fencing, curbing, striping, signage, guardrails, paving, lighting, retaining walls and miscellaneous related work.
13. Landscape work
14. Finish grading and paving
15. Site work water mains, electric and gas services
16. Sanitary sewer systems, including manholes and exterior grease traps
17. Concrete work in connection with site preparation and development

D. Perform all work in accordance with all applicable local, state, and federal codes, laws, and ordinances.

E. Sediment and erosion control procedures shall be performed as required and in conformance with Specification Section 312500; and for LEED Certified projects, in accordance with the requirements of LEED SS Prerequisite 1

F. If the project is of a size and scope that requires a Storm Water Pollution Prevention Plan (SWPPP) refer to additional documentation provided elsewhere herein and conform to its requirements in conjunction with and as related to this section.

1.03 GENERAL PROVISIONS:

A. Verifying Existing Conditions:

1. The Contractor, before submitting his bid, shall examine the site to which this work is in any way dependent upon according to the intent of these Specifications and accompanying Drawings. He shall report to the Architect, in writing, prior to his bid any conditions which prevent him from performing his work. No "Waiver of Responsibility" for inadequate, incomplete, or defective work will be considered by the Architect unless written notice has been filed by the Contractor.

a. Cooperation:

1) When a project involves construction on an existing occupied site, the work called for in this Specification and indicated on the accompanying Drawings shall be carried on in conjunction with the continued operation of the existing building and shall be so arranged that its installation and operation will conform with and facilitate the early installation of work.

2) The Contractor shall bear the expense required to revise his work due to any failure to coordinate the installation of his work with that of the building's operation.

3) The Contractor shall be responsible for the distribution and information concerning his work as required for the prompt installation and coordination with other trades.

b. Accessibility and Clearances:

1) The Contractor shall inform himself fully regarding peculiarities and limitations of space for the installation of the materials and equipment under Division 31, 32 & 33. He shall verify all dimensions and conditions in the field. No extra compensation will be allowed because of differences between actual dimensions and the sizes shown on the Drawings.

2) The Contractor shall see that equipment and apparatus necessary to be reached from time to time for operation and maintenance are made easily accessible.

3) Although the location of items may be shown on the Drawings in a specific place, the construction may disclose the fact that the location for this work does not make its position easily and quickly accessible. In such case, the Contractor shall call the Architect's attention to same before installing the work and shall be guided by the Architect's instruction.

1.04 PRELIMINARY WORK:

A. Before starting the work, make a thorough inspection of the work area to determine the physical condition of natural features and adjacent improvements to remain.

B. Provide complete mark out/tone out of existing utilities for coordination of proposed work. Repair any damage that occurs to existing utilities to remain at no additional cost to the owner.

C. Notify all authorities owning utility lines running to or on the property. Protect and maintain all utility lines that are to remain on the property and cap those that are not required in accordance with the

instructions of the utility companies or local authorities having jurisdiction over them.

PART 2 - PRODUCTS

This part not used.

PART 3 – EXECUTION

3.01 PROTECTION:

A. The Contractor shall effectively protect, at his expense, all materials and equipment, including his employees, during the period of construction, and he shall be held responsible for all damage done to his work, until the same is fully accepted by the Architect.

B. Provide protection necessary to prevent damage to existing building(s), concrete, pavement, utilities or vegetation indicated on the Contract Documents to remain. Box or otherwise protect from damage all trees, shrubs, lawns, etc. which are to be preserved. Trees shall be kept free from guy lines. Remove all protection when work is completed and when authorized to do so by the Architect.

C. Protect improvements on adjoining properties and on Owner's property.

D. Restore damaged improvements to original condition as acceptable to Architect and/or Owner.

E. Protect the property, adjoining properties, wetlands, etc. from damage by soil erosion by installing silt fences and hay bales or as indicated in the projects Storm Water Pollution Prevention Plan, if one is applicable.

F. Conduct site operations to ensure minimum interference with parking lots, roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct parking lots, streets, walks, or other occupied or used facilities without permission from the Owner and/or authorities having jurisdiction.

G. Provide traffic control as required, in accordance with the New York State Department of Transportation "Manual of Uniform Traffic Control Devices" and the local jurisdiction traffic safety requirements.

H. Streets, roadways, parking lots, etc. shall be thoroughly cleaned and/or swept on a daily basis.

3.02 CLEARING and GRUBBING:

A. Clear and grub in the areas of the proposed building, paved areas and/or site improvements in preparation for rough grading and new construction.

B. Completely remove all trees, shrubs, stumps, roots, vegetation, growth, paving, boulders, rocks, rubbish, and all other material interfering with the installation of new construction or not suitable for rough or finished grading, except trees or shrubs directed or indicated to remain.

C. Remove all roots 1" in diameter or larger. Remove all boulders and rocks larger than 3" in largest dimension.

D. Remove all topsoil, peat, and soils containing a high degree of organic matter. (Coordinate with Item 3.03 below)

E. Remove all soft clay soils and rubbish fills.

F. Excavation resulting from the removal of trees, roots, and the like shall be filled with suitable on-site material or imported fill as approved by the Architect/Engineer. Place fill material in horizontal layers not exceeding 8" loose depth, and thoroughly compacted per fill requirements.

3.03 STRIPPING and STOCKPILING EXISTING TOPSOIL:

A. Existing topsoil and sod on the site within area designated on the drawings shall be stripped to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Cut heavy growths of grass from areas before stripping.

B. Free the topsoil of stones, roots, brush, rubbish, clay or other unsuitable materials/objects over 2” in diameter and remove the latter from the premises before stockpiling the topsoil.

C. Care shall be taken not to contaminate the topsoil with clay or other unsuitable materials and remove the latter from the premises before stockpiling the topsoil.

D. Stockpile topsoil in storage piles where indicated or permissible within site staging perimeter (coordinate with Architect and/or Construction Manager). Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Excess topsoil shall be removed from the site by the Contractor unless specifically noted otherwise on the drawings.

E. Refer to soil erosion and sediment control drawing, if included, for additional details.

3.04 DEMOLITION:

A. Existing structures (where indicated), concrete and paving on the site (where indicated), including all existing/discovered inactive cesspools, cisterns, wells, foundation materials shall be completely demolished and all debris removed from the site. Excavation resulting from the removal sub-surface structures, foundations/footings shall be filled with suitable on-site material or imported fill as approved by the Architect/Engineer. Place fill material in horizontal layers not exceeding 8" loose depth, and thoroughly compacted per fill requirements.

B. Remove existing above grade and below grade improvements and abandoned underground piping or conduit as shown on the drawings or necessary to permit construction and other work.

C. All work shall be executed in such a manner as not to endanger the safety of the workmen or the public. All barriers and precautionary measures shall be erected as required.

3.05 REMOVAL and DISPOSAL:

A. Dispose of all debris resulting from the work of this section. Haul off site and dispose of legally.

B. Do not burn rubbish, organic matter, etc. on the site.

C. Do not bury concrete, rock, stumps/roots, etc. on the site.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 310002 – STAKE OUT

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all plants, labor, tools, appliances, equipment, materials, and services required for the work indicated on the drawings and specified for this section.

PART 2 - MATERIALS

2.01 PRODUCTS

A. Not applicable to this section.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall employ a competent registered (New York State) surveyor to lay out the work and to establish all points, lines, and grades necessary for the proper execution of the work. The surveyor shall contact the Owner's representative before laying out the work at the site in order to coordinate the proper alignment of the work.

B. The Contractor shall have his engineer or surveyor place a sufficient quantity of stakes so that the location of all items to be installed can be clearly determined. This portion shall also be coordinated with the Owner's representative before commencing work.

C. At the completion of the work, the Contractor must submit to the Owner's representative a signed certification of the accuracy of the vertical elevations and horizontal locations of the work in relation to the contract plans. This must take the form of "as-built" drawings (a transparency of the contract plans may be used) and shall bear the signature and registration number of a registered New York State surveyor hired by or in the employ of the Contractor. This will be strictly enforced so that the Owner may have an accurate record of the completed work.

D. Should any discrepancy be found between points, lines, or grades shown on the drawings and actual conditions found in the field, the Contractor shall immediately notify the Owner's representative of such discrepancy, and the Contractor will not proceed with the work affected thereby until he has received the necessary instructions from the Landscape Architect or his representative.

E. The Contractor shall carefully maintain any benchmarks, monuments, and other reference marks, and, if disturbed or destroyed, replace as directed. All markers, permanent stakes, and any other reference marks used in the layout shall be left in place as directed by the Owner's representative.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions in the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Under this Section, the Contractor shall clear, grub, demolish and remove all items as shown on the plans, and as encountered during work. The Contractor shall remove trees, shrubs, boulders, debris, waste material, pavements, footings, drainage utilities and other items as shown on plans or encountered during grading operations, and as directed by the Engineer including but not limited to the following:

1. Protecting existing trees and vegetation to remain**.**
2. Removing trees and other vegetation.
3. Stripping topsoil and disposing of excess or stockpiling surplus as noted on the drawings or directed by the Engineer.
4. Clearing and grubbing site of trees, shrubs, grass, and other vegetation, including stumps, roots, and debris.
    a. Fill depressions caused by cleaning and grubbing.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
    a. Arranging to Shut Off Utilities: By Contractor.
7. Disconnecting, capping or sealing, and removing site utilities.
8. Legally disposing demolished and waste materials off Owner's property.

B. The Contractor shall furnish, install, maintain and remove temporary construction and sediment control fencing in accordance with Specification Section 312500.

C. The Contractor is required to inspect the site prior to bidding and shall accept it in its present condition and maintain the site during the construction period.

1.03 RELATED SECTIONS

A. Section 310000 – Earthwork

B. Section 310001 – Site Work General Provisions

C. Section 310002 – Stake Out

D. Section 312500 – Erosion and Sediment Controls

E. Section 312510 – Temporary Tree and Plant Protection

1.04 REGULATORY REQUIREMENTS

A. Herbicides: Comply with the rules and regulations of the Department of Environmental Conservation Title 6, Chapter 4 Quality Services, Parts 320 through 329.

B. Owner approval in writing is required prior to applying herbicides.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Tree Pruning Compound: Waterproof, antiseptic, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants.

B. Herbicides: A chemical or a combination of chemicals which, according to the manufacturer's label, will kill stumps and roots. Deliver herbicides to the site in original manufacturers containers indicating type and percentage of chemical, and application instructions.

PART 3 - EXECUTION

3.01 SUMMARY

A. Clearing and grubbing shall include removal of trees, shrubs, groundcover plantings and their complete root systems, in accordance with the plans, specifications and directions of the Engineer.

B. All materials removed under this section shall be properly and legally disposed of off site at the expense of the Contractor.

C. The Contractor shall keep the site clear of all refuse and rubbish that may accumulate from his operations, and shall maintain such places in a neat condition.

D. All debris or other material necessary to be disposed of shall be placed in dumpsters and shall not be dumped or placed within the limits of the site.

E. The Contractor shall remove and dispose of all items of work as required to complete all work in accordance with the plans, specifications and directions of the Engineer.

F. Keep staging area and material storage within the Limit of Work line unless otherwise approved by the Owner.

G. The Contractor shall restore all pavements, grass, fences and other items disturbed during construction to match existing conditions to the satisfaction of the Owner.

H. The Contractor is apprised that the construction site is located in a residential and commercial area and that vehicular and pedestrian traffic must be protected and controlled in and around the project site at all times.

I. The Contractor shall verify with each of the utility agencies owning or controlling any services or appurtenances which may be affected by the work sufficiently in advance of demolition to permit ample time to do so such work as they deem necessary. This notification must be made prior to

the commencement of demolition and removal of the appurtenances. The Contractor shall cooperate with local authorities and utility companies in protecting such services and appurtenances as may be exposed to hazard during the work.

J. All necessary permits required by the owner, utility companies, or other interested authorities shall be obtained by the Contractor before starting any work. These permits and the terms thereof shall be the sole responsibility of the Contractor who shall pay all fees and make all arrangements with the interested authorities. The Contractor shall furnish the Engineer with signed copies of the necessary permits.

3.02 PREPARATION

A. Protection:

1. Prevent damage to buildings, pavement, pipes, conduits, poles and other structures above and below ground that are adjoining or included in the contract area. Repair damage resulting from the contractor's negligence.

2. Clearly mark out limit of removals for review by the Engineer.

3. Protect existing trees and shrubs not to be removed. Cut back to point of branching all broken branches and skinned areas. Treat exposed wood with tree pruning compound.

4. Store materials and equipment in cleared areas away from tree roots. Prevent employees and equipment from trampling over woodland, existing planting, and established lawns.

3.03 REMOVALS

A. Remove all living or dead tree and shrub growth where indicated or specified.

B. Top and limb all trees before felling, unless otherwise approved by the Engineer.

C. Cut all stumps 6 inches above ground. Apply a herbicide to the stumps and root area in accordance with the manufacturer's application instructions. Mix a red or yellow dye with the herbicide for identification purposes.

D. Chip out stumps to a depth of not less than 6 inches below finished grade. Backfill stump holes with topsoil.

3.04 PRUNING

A. Prune trees where indicated of undesirable wood with the resulting crown shaped to the natural habit of the tree. Remove all diseased and dead branches, and branches interfering with healthy growth. Scar trace bark wounds as directed. All cuts shall be cleanly made with sharp tools, flush with the parent trunk or limb. Paint cuts over 3 inches in diameter with tree pruning compound.

3.05 CLEAN UP

A. Remove and dispose of all logs, tree trimmings, and debris from the property. Leave Work area in a neat uncluttered condition.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 312317 – TRENCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions in the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:

1. Excavating trenches for utilities and utility structures.
2. Bedding.
3. Backfilling and compacting to subgrade elevations.
4. Sheeting and Shoring.
5. Dewatering.
6. Compacting backfill material.

B. Related Sections include the following:

1. Section 310000 – Earthwork
2. Section 312500 – Erosion and Sediment Controls
3. Section 312318 – Rock Removal
4. Section 331000 – Water Systems
5. Section 333000 – Sanitary Sewerage
6. Section 334000 – Storm Drainage Utilities

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand- Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.04 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Utility Structures: Manholes, catch basins, inlets, valve vaults, hand holes, and other utility access structures as indicated on Drawings.

C. Trench Terminology:

1. Foundation: Area under bottom of trench supporting bedding.
2. Bedding: Fill placed under utility pipe.
3. Haunching: Fill placed from bedding to center line of pipe.
4. Initial Backfill: Fill place from center line to 6 to 12 inches above top of pipe.
5. Final Backfill: Fill placed from initial backfill to subgrade.

1.05 SUBMITTALS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New York.

C. Dewatering Plan if required: Describe methods of dewatering and disposal of water.

D. Product Data: Submit data for geotextile fabric indicating fabric and construction.

E. Samples: Submit to testing laboratory, in air-tight containers, 10-pound sample of each type of fill.

F. Materials Source: Submit name of imported fill material suppliers.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Section 014523 – Tests, Inspections and Special Inspections.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.08 COORDINATION

A. Section 013000 – Special Procedures and Provisions: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.01 BACKFILL MATERIALS

A. Subsoil Fill: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel

lumps larger than 2 inches in any dimension; debris; waste; frozen material; and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as subsoil fill under optimum moisture conditions.

B. Granular Fill: Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM or SP-SC.

C. Foundation Stone: Clean course aggregate Gradation No. 57.

D. Bedding and Haunching Material.

1. Rigid Pipe: Granular Fill.
2. Flexible Pipe: Foundation Stone.

E. Bedding for Structures: Foundation Stone.

F. Initial Backfill to 6 inches Minimum Above Utility:

1. Rigid Pipe: Subsoil Fill.
2. Flexible Pipe: Foundation Stone.

G. Final Backfill to Subgrade:

1. Under Pavement: Granular Fill.
2. Under Landscape: Subsoil Fill.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-woven, non-biodegradable.

B. Concrete: Concrete conforming to Section 033000 – Cast-In-place Concrete Work.

1. Compressive strength of 3,000 psi at 28 days.
2. Air entrained.
3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
4. Maximum slump of 3.5 inches for vibrated concrete and 4 inches for non-vibrated concrete.
5. Minimum cement content of 564 lbs per cubic yard for vibrated and 602 lbs. per cubic yard for non-vibrated concrete.

PART 3 - EXECUTION

3.01 PREPARATION

A. Call local utility line information service indicated on Drawings not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating

equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.02 LINES AND GRADES

A. Excavate to lines and grades indicated on Drawings.

1. Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.03 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove lumped subsoil, boulders, and rock up of 1/3 cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18.

C. Perform excavation within 48 inches of existing utility service in accordance with utility's requirements.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Remove water or materials that interfere with Work.

F. Trench Width: Excavate bottom of trenches maximum 16 inches wider than outside diameter of pipe or as indicated on Drawings.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

H. Maintain vertical faces to an elevation equal to 12 inches above top of pipe.

1. When Project conditions permit, side walls may be sloped or benched above this elevation.
2. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.

I. Support Utilities and Structures:

1. Keep trench width at top of trench to practical minimum to protect adjacent or crossing utility lines
2. Support utilities crossing trench by means acceptable to utility company.
3. Do not interfere with 45-degree bearing splay of foundations.
4. Provide temporary support for structures above and below ground.

J. When subsurface materials at bottom of trench are loose or soft, excavate to firm subgrade or to depth directed by Engineer.

1. Cut out soft areas of subgrade not capable of compaction in place.
2. Backfill with foundation stone and compact to density equal to or greater than requirements for subsequent backfill material.

K. Trim Excavation: Hand trim for bell and spigot pipe joints where required. Remove loose matter.

L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

M. Place geotextile fabric over trench foundation stone prior to placing subsequent bedding materials.

3.04 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work unless approved by Engineer.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water, or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.05 SURFACE WATER CONTROL

A. Control and remove unanticipated water seepage into excavation.

B. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 312500 – Erosion and Sediment Controls.

C. Divert surface water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

3.06 DEWATERING

A. Design and provide dewatering system to permit Work to be completed on dry and stable subgrade.

B. Operate dewatering system continuously until backfill is minimum 2 feet above normal ground water table elevation.

C. When dewatering system cannot control water within excavation, notify Engineer and stop excavation work.

1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

D. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

E. Discharge ground water and seepage water within excavation areas through filter bags or into settling basins prior to pumping water into drainage channels and storm drains.

F. Remove dewatering and surface water control systems after dewatering operations are

discontinued.

3.07 BEDDING, HAUNCHING AND INITIAL BACKFILL

A. Place bedding full width of trench to the depth indicated on Drawings and compact to 95 percent maximum density. Excavate for pipe bells.

B. Install utility pipe and conduit in accordance with the respective utility section.

C. Support pipe uniformly along entire length of pipe.

D. Carefully place haunching material to center of pipe, rod and tamp material to fill voids and provide uniform support of pipe haunches. Compact to 90 percent maximum density.

E. Carefully place initial backfill to 6 inches above top of pipe or to depth indicated on Drawings. Compact to 95 percent maximum density.

3.08 FINAL BACKFILLING TO SUBGRADE

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place fill material in continuous layers and compact in accordance with schedule at end of this Section.

D. Employ placement method that does not disturb or damage utilities in trench or foundation perimeter drainage.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Do not leave more than 50 feet of trench open at end of working day.

G. Protect open trench to prevent danger to the public.

3.09 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess material offsite and legally.

B. Furnish Engineer with certificate of disposal site or agreement from private property owner.

3.11 FIELD QUALITY CONTROL

A. Section 014523 – Tests, Inspections and Special Inspections: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557 or AASHTO T180.

C. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

E. Frequency of Tests: Two tests per lift for every 1000 feet of trench.

3.12 PROTECTION OF FINISHED WORK

A. Section 017000 – Contract Closeout: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.13 SCHEDULE OF COMPACTION

A. Under Pavement and Slabs:

1. Granular Fill in maximum 8-inch loose lifts.
2. Compact to minimum 95 percent maximum density except the top 12 inches.
3. Compact top 12 inches to minimum 95 percent maximum density.

B. Under Landscape Areas:

1. Subsoil Fill in maximum 8-inch loose lifts.
2. Compact to minimum 90 percent maximum density.

C. In Unstable or Unsuitable Trench Foundation Areas:

1. Foundation Stone in maximum 12-inch loose lifts.
2. Compact to 98 percent maximum density.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 312318 – ROCK REMOVAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions in the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:

1. Removing identified and discovered rock during excavation.
2. Expansive tools to assist rock removal.
3. Explosive tools to assist rock removal.

B. Related Sections include the following:

1. Section 310000 – Earthwork

1.03 REFERENCES

A. National Fire Protection Association:

1. NFPA 495 - Explosive Materials Code.

1.04 DEFINITIONS

A. Rock: Solid mineral material with volume in excess of 1/3 cubic yard or solid material that cannot be removed with 3/4 cubic yard capacity excavator without drilling or blasting.

1.05 SUBMITTALS

A. Submissions shall be in accordance with Section 013300 – Submittal Procedures and as modified below.

B. Shop Drawings: Indicate proposed method of blasting, delay pattern, explosive types, and type of blasting mat or cover. Indicate intended rock removal method.

C. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 495.

B. Seismic Survey Firm: Licensed company specializing in seismic surveys with five years documented experience.

C. Explosives Firm: Company specializing in explosives for disintegration of rock with five years documented experience.

1.07 PROJECT CONDITIONS FOR USE OF EXPLOSIVES

A. Conduct survey and document conditions of buildings near locations of rock removal prior to blasting; photograph existing conditions identifying existing irregularities.

B. Advise owners of adjacent buildings or structures, in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.

C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.08 SCHEDULING

A. Schedule Work to avoid disruption to occupied buildings nearby and conform to local laws and regulations pertaining to blasting times.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conform to NFPA 495.

B. Explosives, Delay Devices, and Blast Mat Materials: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.

C. Mechanical Disintegration Compound: Grout mix of materials that expand on curing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 013000 – Special Procedures and Provisions: Coordination and project conditions.

B. Verify site conditions and note subsurface irregularities affecting Work of this Section.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.

1. Drill holes and use expansive tools, wedges, and mechanical disintegration compound to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for footings and foundations.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 16 inches wider than pipe diameter.

E. Remove excavated materials from site.

F. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 310000 – Earthwork.

3.04 ROCK REMOVAL BY EXPLOSIVE METHODS

A. When rock is uncovered requiring explosives method for rock disintegration, notify Architect/Engineer prior to executing as follows.

1. Provide seismographic monitoring during progress of blasting operations.
2. Drill blasting holes within 12 feet of finished slope.
3. Disintegrate rock and remove from excavation.
4. Remove rock at excavation bottom to form level bearing.
5. Remove shaled layers to provide sound and unshattered base for footings and foundations.
6. In utility trenches, excavate to 6 inches below invert elevation of pipe and 16 inches wider than pipe diameter.
7. Remove excavated material from site.
8. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 310000 – Earthwork.

B. Notify affected parties 72 hours in advance of using explosives including:

1. Home owners.
2. Schools
3. Fire department.
4. Rescue.
5. Emergency management.
6. Local Law Enforcement department.
7. Department of Transportation.
8. Railroads

3.05 FIELD QUALITY CONTROL

A. Section 014523 – Tests, Inspections and Special Inspections: Field inspecting, testing, adjusting, and balancing.

B. Request visual inspection of foundation bearing surfaces by Architect/Engineer and inspection agency before installing subsequent work.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 312500 – EROSION AND SEDIMENT CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:

1. The Contractor, as a part of the site development, is responsible for the installation and maintenance of erosion and sedimentation control measures necessary to prevent the transportation of sediments to off-site areas. As such, he shall provide all labor, materials, equipment, tools and incidentals required to assure adequate environmental protection including implementation of all erosion and sediment control measures and site restoration measures as shown, specified and required to complete the Work. For projects that require a specific stormwater pollution prevention plan (SWPPP), see related information provided by others and incorporated within the contract documents.

2. Includes the installation, maintenance, adjustments, dismantling, removal and disposal of all soil erosion and sediment control measures required by the Project.*

3. Includes the disposal by the Contractor of all sediment and erosion control materials removed in legal fashion at an off-site location of the Contractor's choice.

4. Includes the control of dust by the application of water, or other means acceptable to the Architect/Engineer. *Use of Calcium Chloride is prohibited.*

* The specific methods and materials employed in the installation and maintenance of erosion control measures shall conform to the *New York State Stormwater Management Design Manual* and the *New York Standards and Specifications for Erosion and Sedimentation Control*.

B. For all Projects and for LEED Certified Projects: Soil and Erosion Control Measures must meet the requirements of LEED SS Prerequisite 1 by conforming to the Best Management Practices of the U.S. Environmental Protection Agency (EPA) Document No. EPA 832/R-92-005 (September 1992), Storm Water Management for Construction Activities, Chapter 3, or local erosion and sedimentation controls standards and codes, whichever is more stringent. The SWPPP/environmental plan shall meet the following objectives:

1. Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protection of soil stockpiles, utilizing jute mesh or erosion control blanket material.

2. Prevent sedimentation of storm sewer or receiving streams.

3. Prevent polluting the air with dust and particulate matter.

C. Coordination:

1. The Contractor shall review requirements and procedures under other sections as specified in D below and coordinate with the Work that is related to this Section.

2. The Contractor shall comply with applicable NYSDEC regulations.

3. The Contractor shall comply with applicable NYCDEP regulations for protection of New York City lands.

4. The Contractor shall comply with Stormwater Pollution Prevention Plan Report, if one has been provided for this project.

5. If the project is of a size and scope that requires a stormwater pollution prevention plan (SWPPP), refer to additional documentation provided elsewhere herein, and conform to its requirements in conjunction with and as related to this Section.

D. Related Sections:

1. Section 015000 – Temporary Facilities and Controls
2. Section 013563 – LEED Requirements
3. Section 310000 – Earthwork
4. Section 310001 – Site Work General Provisions
5. Section 329200 – Turf and Grasses

1.02 APPLICABLE REGULATIONS

A. In the performance of the Contract, the Contractor and any Subcontractors shall comply with all applicable Federal, State, and local municipal laws and regulations concerning environmental protection and erosion and sediment control.

B. The Contractor shall comply with the following design standards and guidance documents:

1. *Construction Activity Erosion and Sediment Control Measures: "New York Standards and Specifications for Erosion Control", published by the Empire State Chapter of the Soil and Water Conservation Society. (The Blue Book).*

2. *Post-Construction Stormwater Control Practices, for water quality/quantity controls: "New York State Stormwater Management Design Manual", prepared by Center for Watershed Protection, for NYSDEC.*

3. *New York City Department of Environmental Protection, The Applicant's Guide to Stormwater Pollution Prevention Plans and Crossing, Piping or Diversion Permits, prepared by NYCDEP Bureau of water Supply Quality and Protection, Engineering and Operations Division, August 2002.*

4. *New York State Stormwater Management Design Manual.*

5. *New York State Dept. of Transportation (NYSDOT) Standard Specifications Construction & Materials, January 2, 1990 & Latest Editions & Addenda.*

The Contractor shall maintain a copy of each of these documents readily available for continuous reference thereto. The Contractor shall also keep a copy of Stormwater Pollution Prevention Plan, if one exists for this project, on site for continuous reference hereto.

C. The Contractor shall comply with NYSDEC SPDES General Permit No. GP-02-01 for Stormwater Discharges from construction activity.

1.03 SUBCONTRACTORS

A. Compliance with the provisions of this Section by Subcontractors shall be the responsibility of the Prime Contractor.

1.04 SUBMITTALS

A. **LEED Submittals: Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 "LEED Requirements". (For LEED Certified Projects only)**

B. All submissions shall be made in accordance with the provisions of Section 013300.

C. Certification Statement – When a SWPPP is provided, all Contractors and Subcontractors shall submit a signed and sealed copy of the following certification statement on company letterhead before undertaking any construction activity at the site identified in the Stormwater Pollution Prevention Plan:

"I certify under penalty of law that I understand and agree to comply with the terms and conditions of the Stormwater Pollution Prevention Plan for the construction site identified in such Stormwater Pollution Prevention Plan as a condition of authorization to discharge stormwater. I also understand that the operator must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards."

D. The certification must include the name and title of the person providing the signature in accordance with the General Permit; the name, address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date of the certification is made.

E. For projects without a SWPPP, prior to commencement of the Work, the Contractor shall submit to the Architect/Engineer, in writing, an Environmental Plan. The plan must be prepared by a NYS licensed Professional Engineer. The Environmental Plan shall describe proposed methods and schedules for environmental protection, restoration, and erosion and sediment control. At a minimum, the Environmental Plan elements must conform to the requirements and procedures shown and specified, and to the NYSDEC and NYCDEP regulations. It shall describe the Contractor's compliance with the requirements and procedures, as well as modifications or additions necessitated by specific site conditions or construction/restoration schedules.

1. As a minimum, the Contractor's Environmental Plan shall contain:

   a. The construction schedule including projected dates of clearing, construction, and restoration.

   b. A description of the sequence of operation and environmental precautions to be employed during construction of the site improvements.

   c. Erosion control measures to be implemented prior to completion of restoration.

   d. A drawing or series of drawings indicating width of the temporary work limits, extent of clearing and grubbing, location of stockpile and storage areas, location of hay bales and other erosion control devices, and placement of dewatering settlement basins (if required by project scope).

   e. Location of any disposal areas for excess excavated fill, subject to the approval of the Architect/Engineer. Disposal of materials shall be at approved and licensed landfills.

   f. Procedures for the preservation of existing vegetation, where practical, and restoration including, where appropriate, stone stabilization of stream banks and beds, fertilizing, seeding, and mulching, and soil stabilization matting such as jute netting.

F. The Contractor shall revise and resubmit the Plan until it is approved by the Architect/Engineer.

G. Material Submittals: Provide detailed material submittals, and as available, technical manufacturer's product data, for all items listed under 2.01 below.

PART 2 - MATERIALS

2.01 GENERAL

A. Vegetated surface restoration products shall conform to the applicable requirements of Sections 329200 and 329300.

B. Soil Erosion and Sediment Control Materials:

1. **Silt fence** shall conform to NYSDOT Section 209-2.08 ("Soil Erosion & Sediment Control-Silt Fence") requirements. A silt fence assembly shall consist of silt fence geotextile fabric, jute mesh, burlap fabric, excelsior blankets, setting posts, and fasteners and may include mesh support/plastic netting consistent with the NYSDOT Standard. Note: Geotextile fabric, unless otherwise noted, shall meet the requirements of NYSDOT 207-2 Materials, Geotextile Stabilization, Strength Class 1.

2. **Hay bales** shall be full size, unbroken and not rotted, and shall meet the requirements of NYDOT 209-2.04.

3. **Gravel bags** shall be fabricated from reinforced woven geotextile and shall include ties. No burlap bags shall be allowed. Coarse aggregate shall meet the gradation requirements of size designation #1 or #2 of table 703-4 from NYSDOT specifications and shall be used as the fill material. Each gravel bag shall be individually tied and double bagged. The bag with fill material shall be inversely inserted into the second bag in order to prevent leaking.

4. **Mulch** shall be straw or wood fiber mulch and shall meet the requirements of NYSDOT 209-2.01.

5. **Construction Entrances** shall consist of a geotextile fabric, crushed stone, RCA or gravel and if necessary, a drainage pipe to maintain ditch flow.

    a. Geotextile shall meet the requirements of NYSDOT 207-2 Materials, Geotextile Stabilization, Strength Class 1.

    b. Crushed Stone, RCA or Gravel shall be 150 mm of coarse aggregate material meeting the gradation requirements of size designation #3 on Table 703-4.

    c. The Contractor shall provide a drainage pipe sized with sufficient capacity to carry ditch flow.

    d. The construction entrance shall be maintained by the Contractor in a condition which will prevent tracking or flowing of sediment onto the right-of-way. All sediment spilled, dropped, washed, or tracked onto the right-of-way shall be removed immediately. In the event the entrance is no longer performing properly (i.e. the entrance aggregate becomes clogged with sediment), the contractor shall top-dress the entrance with additional coarse aggregate material.

C. Dust Control Materials: Water shall be potable and shall be obtained from an off-site source. Use of calcium chloride is prohibited.

D. Temporary water for truck washdown and dust control shall be provided by and be the complete responsibility of the General Contractor. Tire wash locations shall be as indicated on Construction Implementation Plans; where not indicated, on CIP, the General Contractor shall supply his proposed location(s) for washdown and written methodology.

E. Soil Stockpile Protection: Provide either 14 ga. geotextile silt fence fabric material, jute mesh, or soil erosion control blankets (similar or equal to R-1 Excelsior Series by Western Landscape and Geotextile Supply Corp., 5065 Colorado Boulevard, Denver, Colorado, 80216 - ph. (720) 941-3833.

PART 3 - EXECUTION

3.01 PROHIBITED CONSTRUCTION PROCEDURES

A. Prohibited construction procedures include, but are not limited to:

1. Dumping of spoil material into any stream corridor, any wetlands, any surface waters, or at unspecified locations.

2. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, or any surface waters.

3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors, or any wetlands.

4. Damaging vegetation adjacent to or outside of the access road or the right-of-way.

5. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

6. Permanent or unspecified alternation of the flow line of the stream.

7. Open burning of project debris.

8. Applying any pesticides, including defoliants, desiccants, and plant regulators, in any wetlands containing significant stands of high vigor spartina alterniflora (saltmarsh cordgrass), zizania aquatica (wild rice), typhasp (cattail), and scirpus americanus (common threesquare).

9. Applying pesticides whose residues and metabolic products persist in the environment over extended periods of time.

10. Use of chemicals for dust control, including calcium chloride.

11. Use of asphaltic mulch binder.

3.02 EMERGENCY VEHICLE ACCESS

A. The Prime Contract(s) shall provide temporary access to all Fire, Police, Ambulance, Hospital, or other emergency vehicles, where his construction procedures or activities directly impact the access to the Owner’s facilities. Arrangements for temporary access shall be fully coordinated directly with the affected emergency department, the municipality which they serve and the Contractor.

3.03 CONSTRUCTION DETAILS

A. Verify existing conditions prior to start of work each day. This is an active site that is in constant ongoing use. Control of dust, erosion and sediment is of extreme importance.

B. Erect soil erosion and sediment control measures as shown on the plans, and at all locations of existing drainage along adjacent streets at all locations of existing on-site drainage, at newly installed drainage, along site driveways that are down-gradient from the items of work, and as directed by the Architect, Engineer and/or Construction Manager.

C. Implementation and maintenance shall be acceptable to the NYSDEC Division of Water.

D. Approved Silt Fence shall be erected at all locations where storm water flow will cause erosion. The more appropriate of manufacturer's instructions or plan details shall be followed in order that the installation perform in a satisfactory manner. Silt Fence shall only be removed after up-slope areas have been stabilized to avoid danger of washouts with deposition of soil and debris on adjacent areas.

E. Approved Hay Bales or gravel bags shall be installed around all existing drainage structure castings on site and along adjacent streets that may be impacted by the Work, or as directed by the Engineer. Hay Bales shall only be removed after up-slope and up-gradient areas draining to the line of Hay Bales have been stabilized to avoid danger of washouts with deposition of soil and debris on adjacent areas.

F. Approved Dust Control shall be performed on any day that dust from the work site may be blown into any portion of the project site or onto any portion of the surrounding roads and property adjacent to the work site. In the event that dust from the Contractor's operations becomes built-up off of the work site in any quantity, and at any location noted herein, the Contractor shall be required to take actions to correct this condition.

G. The Contractor shall install a Stabilized Construction Exit Pad (see detail and location on the plans, or in accordance with standard construction practice and as located on site via start of work. Location to be coordinated with the Owner's Representative. The Contractor shall be responsible for insuring that all vehicles exiting the site cross over the Exit Pad in an effort to prevent soil and other debris from the site from being deposited on off-site roadways. The Contractor shall be responsible for maintaining the efficiency of the Pad stone such that it accomplishes the task intended. In the event that crossing over the Exit Pad alone does not remove soil and debris from the vehicles, the Contractor shall provide equipment, personnel, etc., as needed, to wash the soil and debris from the vehicles using water.

3.04 SITE ACCESS AND CLEARING

A. Extent of Clearing and Grubbing: The Contractor shall confine all clearing and grubbing to that portion of the work limits absolutely essential for the construction and installation of the structures and appurtenances, particularly in the vicinity of stream corridors, surface waters, mature trees and steep slopes.

B. Schedule of Clearing: All clearing schedules shall be arranged to provide a minimum practical exposure (in both extent and duration) of soils in order to prevent erosion. As much of the ground cover root structure as is practical shall be left in place to minimize the length of right-of-way or work limit in which construction will be initiated within ten working days.

3.05 STOCKPILING OF MATERIAL

A. After vegetation has been removed, the Contractor shall strip any topsoil from the area to be excavated and stockpile it for future use. At the completion of the work, the Contractor shall legally

remove all excess fill from the site at his own cost.

B. When excavating trenches, the Contractor shall separate suitable backfill material from unsuitable material for use as backfill.

C. Items A & B above shall be done in conjunction with work conducted under 310000 - “Earthwork”.

D. Where topsoil or subgrade material is to be stored, a suitable means of protecting excavated material from wind and water erosion shall be employed. Erosion control methods may include one or more of the following: mulching, sprinkling, silt fencing, hay bales or erosion blankets.

3.06 PROTECTION OF TREES AND SHRUBS

A. The Contractor shall make very effort not to damage adjoining trees and shrubs, other than those he is permitted to cut, within or adjacent to the line of the excavation.

3.07 DEWATERING

A. Turbid water pumped from excavations or working or processing water containing oils or sediments shall be diverted to sediment traps shown in drawings prior to discharge. Extra caution shall be taken when discharge may be directed towards any surface water, stream corridor or wetland area.

3.08 EROSION CONTROL

A. The Contractor shall use necessary methods to minimize erosion within working limits and access roads. Methods of preventing erosion shall include the use of hay bales, silt fence, sediment traps, filter fabric, mulch, and jute or excelsior blankets, as conditions require. Erosion and sediment control methods shall be employed during site clearing, construction, immediately following clearing and backfilling and at the time of final restoration.

B. All erosion and sediment control practices shall be in place until construction is completed and/or the area is stabilized.

C. The Contractor shall provide special attention to areas where slopes are 15 percent or greater. In general, staked hay bales shall be used to minimize erosion on slopes. In steeper areas, staked hay bales and filter fabric shall be used downslope from construction. Jute netting or other means of protection shall be used on exposed slopes until vegetation or other permanent restoration measures are in place.

D. Minimum hay bales, silt fence, sediment traps installation requirements may be shown on the Drawings; if not shown, they shall be provided in accordance with design standards and standard construction practice.

3.09 NOISE CONTROL

A. Noise levels occurring during sediment and erosion control work shall not exceed limits specified by local and state regulations.

3.10 SEDIMENT & EROSION/SEDIMENTATION CONTROL

A. Erosion Control Measures shall include the following:

1. The proposed erosion control shown on the plans shall be installed prior to the start of construction. Additional erosion control may be necessary, based upon field conditions that may develop as construction progresses, and as may be required by the local conditions.

a. Existing vegetation to remain shall be protected and remain undisturbed.

b. Clearing and grading shall be scheduled so as to minimize the size of exposed areas and length of time that areas are exposed.

c. The length and steepness of cleared slopes shall be minimized to reduce runoff velocities and quantities.

d. Runoff shall be diverted away from clear slopes.

e. Sediment shall be trapped on-site.

Specific methods and materials employed in the installation and maintenance of erosion control measures shall conform to the *New York State Guidelines for Urban Erosion and Sedimentation Control*.

2. Sedimentation barriers (silt fence, hay bales, or approved equal) shall be installed prior to any grading work along the limits of disturbances and shall be maintained for the duration of the work. No sediment from the site shall be permitted to wash onto adjacent properties or roads. Where sedimentation barriers are required adjacent to streams, ponds or tidal areas, the silt fence is to be supported by a temporary metal post and chain link fence.

3. Graded and stripped areas and stockpiles shall be kept stabilized through the use of temporary seeding or sod as required.

4. Seed mixtures shall be in accordance with the Soil Conservation Service recommendations.

5. Soils stockpiled on individual lot as a result of excavation for foundations shall be placed to increase the distance these soils must travel to reach the drainage system.

6. Drainage inlets installed as part of the project shall be protected from sediment buildup through the use of sedimentation barriers, sediment traps, etc. as required.

7. Proper maintenance of erosion control measures is to be performed as indicated by the periodic inspection after a rainfall event totaling 0.5 inches of rainfall or greater or during a 14-day inspection program occurring throughout the period of the construction. Maintenance measures include, but are not limited to, cleaning of sediment basins or traps, cleaning and repair of berms and diversions and cleaning and repair of inlet protection.

8. Appropriate means shall be used to control dust during construction. A stabilized construction entrance shall be maintained to prevent soil and loose debris from being tracked onto local roads. In addition, a water source is to be maintained adjacent to this entrance for the purpose of washing debris from truck tires. The construction entrance shall be maintained until the site is permanently stabilized.

9. Sediment barriers and other erosion control measures shall remain in place until upland disturbed areas are permanently stabilized.

10. All 1:2 and 1:3 slope areas will be protected against erosion during construction and permanent ground cover shall be such that erosion will be prevented. Necessary measures shall include, but not be limited to, hay bales, silt fence, silt trap/basins, jute mesh, anchored straw mulch, hydroseeding, sod, etc. and shall be maintained for the duration of the construction as well as following the completion of construction until such time that the proposed plantings have become acclimated/established as determined by the authority having jurisdiction.

B. The plans shall also address the following environmental issues the Contractor shall be responsible

for addressing during construction:

1. Pollution prevention measures to be instituted to prevent litter, construction chemicals, and construction debris from becoming pollutant sources in storm water discharges from the site.

2. Provide a description of the method of storing waste materials on-site and a description of controls to be employed to reduce pollutants from these materials, including storage practices to minimize exposure of materials to storm water will a spill prevention and response plan.

3. The installation of a portable sanitary system or a system established in a field office trailer is to be maintained through the term of the project.

4. All soils stockpiled on the site for future use shall be covered to limit dust pollution and run-off of fines with rain.

5. Site clearing wood chips to be stockpiled for mulch shall be stockpiled in an area away from proposed construction and surrounded by silt fencing.

6. The Contractor shall be responsible for keeping adjacent roadways free of debris washed from the construction site. A street sweeper shall be employed to remove all soil and debris from roadways as often as may be required.

7. All construction debris shall be removed from the site within the same day, or kept in a manner to prevent it from leaving the site with storm runoff or blown from the site by winds.

8. All refuse shall be placed within a covered container for future disposal.

9. The Contractor shall be responsible for the disposal of all excess concrete dumped on the site. Furthermore, the Contractor shall designate a location for washing delivery trucks. This area is to be configured to insure that wash water does not runoff the site to either private property or public roadways. Subsequent to the completion of concrete activities, this area is to be excavated and material to be removed from the site. Suitable soils are to be brought to restore this area.

10. The Contractor shall be responsible for installing catch basin inserts into any and all County-owned catch basins connected to positive drainage systems, which are located adjacent to the project area or located within 100’ of the project area. It is the responsibility of the Contractor to maintain these inserts during the period of the construction in accordance with the manufacturer’s recommendation. At the end of all site work, including the development of individual sites, new media is to be installed and the devices are to be dedicated to the County. All structures are required to have an 80% Total Suspended Solids Removal or as may be specified in the New York State Design Manual. However, if it is determined that the catch basins lying within these limits do not connect to positive systems, and function solely as leaching basins, the Contractor will be responsible for cleaning each at the conclusion of all site work. This does not prevent the County from issuing a request to clean these facilities if it has been determined that the Contractor’s activities have adversely affected their normal function.

C. Sequence of Construction Activities:

1. Install silt fence, sediment traps, and hay bale filters as a part of initial phase of work to ensure maximum silt retention on site.

2. Mass grade the site, keeping disturbed areas to a minimum at all times. Seed and mulch sides of swales, mounds and ponds, immediately upon completion.

3. Control mud accumulation on all streets surrounding the project site by installing stone surface at each location where construction traffic leaves the site. Keep dust to a minimum, by utilizing sprinkling, vegetative cover, spray-on adhesives, or other approved methods.

4. Maintain all filters and traps during construction to prevent any blockages from accumulated sediment. Clean sediment traps, filters and fencing after each storm event as well as on a weekly basis. Replace all materials that are clogged or ineffective.

5. Remove temporary erosion control and sediment controls only when sufficient growth of ground cover is established to prevent further erosion.

D. Monitoring:

1. Monitor soil erosion practices at least weekly to determine the effectiveness of the installation and any repairs which may be required. Keep a detailed log of these observations and remedies taken.

2. Clean out siltation filters when siltation reduces capacity by 20 percent. Material removed may be dried and used as embankment material only, in areas approved by the Architect/Engineer.

3.11 DUST CONTROL

A. Dust control shall be achieved by wetting, sweeping, and temporary mulching. *The use of chemicals for dust control, including calcium chloride, will not be permitted.*

3.12 STABILIZATION

A. The Contractor shall initiate stabilization measures as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. This requirement does not apply in the following instances:

1. Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable.

2. Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within twenty-one (21) days, temporary stabilization measures need not be initiated on that portion of the site.

3.13 MULCHING

A. Where slopes exceed 15 percent or as directed by the Architect/Engineer, mulch in the form of staked jute netting or other material approved by the Architect/Engineer must be installed and maintained until an adequate vegetative cover is established.

3.14 FILL MATERIALS

A. All fill materials shall be stockpiled away from wetland areas and water bodies and surrounded with an overlapping, anchored hay bale barrier.

3.15 SILT DISPOSAL

A. All silt that has accumulated behind hay bale barriers or silt fences shall be removed from the site after it has had sufficient time to dry, and before the hay bales or fences are removed.

3.16 INSPECTION REQUIREMENTS (FOR PROJECTS REQUIRING A SWPPP)

A. Soil erosion and sediment control shall be inspected by a Civil Engineering firm retained independently by the Owner specifically for soil erosion control inspection and all controls shall be maintained during the life of the project, including winter shutdown, etc. Such inspection and maintenance shall continue until after project is complete.

B. All inspections shall be completed within one calendar day. Inspection reports shall be issued within 5 working days from day of inspection. Within 3 calendar days after receipt of the inspection reports, the Contractor shall:

1. Repair or rebuild the control measures to function as originally intended.

2. Remove sediment deposition which reached one half the height of the control measure. All sediment deposits shall be considered unsuitable material and disposed of in accordance with NYSDOT Spec. 203-3.08, Disposal of Surplus Excavated Materials. Material shall be disposed of away from wetland, water courses or other bodies of water.

3. Torn or punctured silt fence fabric may be repaired by the placement of a patch, on the upstream side, consisting of an additional layer of fabric over the damaged area, or replacement of the damaged section.

C. Site inspections shall be conducted by a Civil Engineering firm retained by the Owner specifically for soil erosion control inspection at least every seven (7) calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater. During each inspection, the following information shall be recorded:

1. On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period.

2. Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization.

3. Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period.

4. Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of the sediment storage volume (for example, 10 percent, 20 percent, 50 percent).

5. Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (earthen berms or silt fencing) and containment systems (sediment basins and sediment traps). Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water.

6. The Contractor shall correct all deficiencies that are identified with the implementation of the Stormwater Pollution Prevention Plan.

D. The Contractor shall maintain a record of all inspection reports in a site log book. The site log book shall be maintained on site and be made available to the permitting authority upon request. Prior to the commencement of construction, the Contractor shall certify in the site log book that the

Stormwater Pollution Prevention Plan meets all Federal, State and local erosion and sediment control requirements.

E. The Contractor shall post at the site, in a publicly-accessible location, a summary of the site inspection activities on a monthly basis.

3.17 SYSTEM MAINTENANCE (FOR PROJECTS THAT DO NOT REQUIRE A SWPPP)

A. The Contractor shall conduct regular and routine inspections of the installation and erosion control measures throughout the progression of the work, supplementing and restoring site conditions as necessary to maintain the site.

3.18 SYSTEM REMOVAL AND SITE RESTORATION

A. Restoration Area: All surfaces which have been disturbed or damaged by the Contractor's operations, including streambanks, slopes, dewatering, stockpiling, and equipment storage areas, shall be restored to the condition at least equal to that in which they were found immediately prior to the beginning of construction, or improved as indicated in the Contract Documents. Suitable materials and methods shall be used for such restoration. Grass shall be re-seeded with types compatible with particular areas involved and in conformance with Section 329200. The Contractor shall restore all damaged surfaces outside the work limits.

B. Restoration Schedule: Permanent restoration of vegetative cover shall be initiated only during optimal planting seasons as delineated in Section 329200. At other times, temporary restoration measures shall be implemented and followed by permanent restoration when the first optimal planting season occurs.

C. Restoration of vegetation shall be in conformance with Sections 329200 and 329300.

3.19 WINTER MAINTENANCE (FOR PROJECTS THAT REQUIRE A SWPPP)

A. See the following page for specific requirements.

END OF SECTION

STANDARD AND SPECIFICATIONS FOR WINTER STABILIZATION

Definition & Scope

A temporary site specific, enhanced erosion and sediment control plan to manage runoff and sediment at the site during construction activities in the winter months to protect off-site water resources.

Conditions Where Practice Applies

This standard applies to all construction activities involved with ongoing land disturbance and exposure between November 15th to the following April 1st.

Design Criteria

1. Prepare a snow management plan with adequate storage for snow and control of melt water, requiring cleared snow to be stored in a manner not affecting ongoing construction activities.

2. Enlarge and stabilize access points to provide for snow management and stockpiling. Snow management activities must not destroy or degrade installed erosion and sediment control practices.

3. A minimum 25 foot buffer shall be maintained from all perimeter controls such as silt fence. Mark silt fence with tall stakes that are visible above the snow pack.

4. Edges of disturbed areas that drain to a waterbody within 100 feet will have 2 rows of silt fence, 5 feet apart, installed on the contour.

5. Drainage structures must be kept open and free of snow and ice dams. All debris, ice dams, or debris from plowing operations, that restrict the flow of runoff and meltwater, shall be removed.

6. Sediment barriers must be installed at all appropriate perimeter and sensitive locations. Silt fence and other practices requiring earth disturbance must be installed before the ground freezes.

7. Soil stockpiles must be protected by the use of established vegetation, anchored straw mulch, rolled stabilization matting, or other durable covering. A barrier must be installed at least 15 feet from the toe of the stockpile to prevent soil migration and to capture loose soil.

8. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures should be initiated by the end of the next business day and completed within three (3) days. Rolled erosion control blankets must be used on all slopes 3 horizontal to 1 vertical or steeper.

9. If straw mulch alone is used for temporary stabilization, it shall be applied at double the standard rate of 2 tons per acre, making the application rate 4 tons per acre. Other manufactured mulches should be applied at double the manufacturer's recommended rate.

10. To ensure adequate stabilization of disturbed soil in advance of a melt event, areas of disturbed soil should be stabilized at the end of each work day unless:

    a. work will resume within 24 hours in the same area and no precipitation is forecast or;

    b. the work is in disturbed areas that collect and retain runoff, such as open utility trenches, foundation excavations, or water management areas.

11. Use stone paths to stabilize access perimeters of buildings under construction and areas where construction vehicle traffic is anticipated. Stone paths should be a minimum 10 feet in width but wider as necessary to accommodate equipment.

Maintenance

The site shall be inspected frequently to ensure that the erosion and sediment control plan is performing its winter stabilization function. If the site will not have earth disturbing activities ongoing during the "winter season", **all** bare exposed soil must be stabilized by established vegetation, straw or other acceptable mulch, matting, rock, or other approved material such as rolled erosion control products. Seeding of areas with mulch cover is preferred but seeding alone is not acceptable for proper stabilization.

Compliance inspections must be performed and reports filed properly in accordance with the SWPPP for all sites under a winter shutdown.

DIVISION 31 – EARTHWORK

SECTION 312510 – TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions in the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction, and the general protection and delineation of nearby wetlands.

B. Related Sections include the following:

1. Section 311000 – Site Clearing for removing existing trees and shrubs.

1.03 DEFINITIONS

A. Caliper: Diameter of a trunk measured by the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

D. Wetland Protection Limits: Area in surrounding wetlands to be protected from impacts during construction and indicated on Drawings.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Existing Conditions: Documentation of existing trees, plantings, and wetlands indicated to remain and be protected, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.

1.05 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Excavation or other digging unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

7. Do not direct vehicle or equipment exhaust toward protection zones.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil

1. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of the following:

1. Type: Ground or shredded hardwood
2. Size Range: 3 inches maximum, ½ inch minimum
3. Color: Natural

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft; remaining flexible from minus 60 to plus 200 deg. F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.

a. Height: 4 feet
b. Color: High-visibility orange, nonfading

PART 3 - EXECUTION

3.01 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

A. Locate and clearly identify wetlands, trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at roughly 54 inches above the ground, for all perimeter trees 4-inch caliper and larger, or as ordered by the Landscape Architect or Engineer. Flag the limits of all wetlands within 20 feet of the construction limits.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.03 WETLAND, TREE, AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of tree- and plant-protection zones, and a minimum of 1-foot outside of wetland-protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect, Owner, and Owners Representative. Under no circumstances will disturbance of wetlands be acceptable.

C. Maintain protection-zone fencing in good condition as acceptable to the Owner's Representative and remove when construction operations are complete, and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

3.04 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 310000 – Earthwork.

3.05 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Division 31 Section "Earth Moving."
6. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

3.06 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
2. Do not apply pruning paint to wounds.

B. Chip removed branches and dispose of off-site.

3.07 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the tree- or plant-protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the tree- or plant-protection zone.

1. Minor Fill within Tree- or Plant-Protection Zone: Where existing grade is 5 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

3.08 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect, Owner, and Owner's Representative. Under no circumstances will disturbance of wetlands be acceptable.

1. Submit details of proposed root cutting and tree and shrub repairs.

2. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect or Owner's Representative.

3.09 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 320116 – COLD MILLING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Under this Section, the Contractor shall provide material, labor, and equipment necessary to mill, shape and remove existing bituminous pavements in accordance with the plans and specifications and directions of the Engineer.

B. The work shall consist of cold milling the existing pavement to the depths as noted on the plans. Cleaning of the pavement and tack costing prior to overlaying new pavement, shall also be part of the work.

C. All millings shall be removed from the work areas and become the property of the Contractor.

1.02 RELATED SECTIONS

A. Section 320117 – Pavement Repair and Resurfacing
B. Section 321216 – Asphalt Paving
C. Section 321723 – Pavement Markings
D. Section 321723.11 – Pavement Markings (Thermoplastic)
E. Section 321723.12 – Pavement Markings (Pre-formed Reflectorized)

1.03 SUBMITTALS FOR REVIEW

A. Submittals shall be in accordance with Section 013300.

B. Contractor shall furnish documentation and certification that the milling machine to be used is capable of removing the desired thickness of pavement.

PART 2 – PRODUCTS

2.01 MILLING MACHINE

A. Milling machines shall be power operated, self propelled machines capable of removing the desired thickness of existing pavement. The machine shall have sufficient power, traction and stability to accurately maintain depth of cut and slope.

B. Milling machines shall be capable of producing a finished profile and cross slope to within ¼” of that required and shall produce a uniform surface texture free from gouges and ridges greater than 3/8” in depth.

C. Milling machines shall have an integral loading system or sufficient equipment shall be provided to accomplish complete removal of milled material at a rate equivalent to the milling rate.

D. Vacuum trucks, street sweepers or power brooms shall be used to clean the milled surfaces. The machine shall be equipped with a means to control dust and other particle matter created by the cutting action.

E. All material removed during the milling process, including foreign debris within or on the pavement shall become the property of the Contractor and removed from the site and disposed of in a legal

matter at his/her expense.

PART 3 – EXECUTION

3.01 GENERAL

A. Profile and cross slope shall be controlled by a taut reference string line. The reference elevation and string line shall be established by the Contractor and subject to the approval on the Engineer.

B. The existing slope and pitch of the parking area shall be maintained.

C. Areas not accessible to the milling machine, such as around curbs or fences, may be removed with a small milling machine, handwork or other approved method.

D. Contractor shall remove, store, replace fence and fabric as required to operate milling equipment, where required.

E. All milled material, including that removed by other means, shall be immediately removed from the milled surfaces and adjacent surfaces.

F. Surfaces shall be cleaned of all fines and dust prior to the placement of tack coats, or pavement courses.

G. Milled surfaces to be overlaid shall receive a bituminous tack coat immediately prior to placement of overlay.

H. Damage to milled surfaces, such as raveling, fuel spillage or any contaminants, which would prohibit a good bond with new asphalt shall be repaired or re-milled by the Contractor in a manner approved by the Architect.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 320117 – PAVEMENT REPAIR AND RESURFACING

PART 1 – GENERAL

1.01 GENERAL

A. These specifications are intended to meet the latest edition of the N.Y.S.D.O.T. standard specifications U.S. Edition Section 403. It is the responsibility of the contractor to verify if the portions stated herein are current. This may be done by visiting the N.Y.S.D.O.T. website at: www.nysdot.gov/main/businesscenter/engineering/specificationssupdated-supdated-standard-specifications-us

B. GC shall be responsible for all work to be provide in conformance with sections referred to herein or within specification sections found on the N.Y.S.D.O.T. website.

C. Drawings and General Provisions of the Contract and Supplementary Conditions and Division 01 specification sections, apply to the work of this section.

1.02 SCOPE

A. Under this work the Contractor shall repair deteriorated pavement sections, clean and seal joints and cracks and clean pavement for the installation of new work.

B. New work shall be defined as any combination of the following:

1. Repair of asphalt pot holes and deteriorated sections of pavement.
2. New pavement markings
3. Seal coat
4. Asphalt overlay

1.03 RELATED SECTIONS

A. Section 014523 – Tests, Inspections, and Special Inspections Quality Assurance Plan
B. Section 033000 – Cast-In-Place Concrete
C. Section 310000 – Earthwork
D. Section 310001 – Site Work General Provisions
E. Section 310002 – Stakeout
F. Section 312500 – Erosion and Sediment Controls
G. Section 321216 – Asphalt Paving
H. Section 321216.11 – Asphalt Overlay
I. Section 321723 – Pavement Markings
J. Section 321723.11 – Pavement Markings (Thermoplastic)
K. Section 321723.12 – Pavement Markings (Pre-formed Reflectorized)
L. Section 334000 – Storm Drainage Utilities

1.04 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. The Contractor shall submit an asphalt job mix formula indicating the project name, date, contractor name, asphalt type & plant. The mix shall be in conformance with section 02600 and Table 403-1 Composition of Hot Mix Asphalt Mixtures, shown in that section.

C. The Contractor shall provide asphalt filler documentation proving that material will be obtained from one of the sources on the N.Y.S.D.O.T. approved materials list. Documentation shall also be provided that the filler meets the requirements of Table 702-2 Miscellaneous Asphalt Cements. A copy of the table can be found at the end of Part 2 of this section.

D. The Contractor shall provide asphalt emulsions documentation proving material will be obtained from N.Y.S.D.O.T. approved source. Additionally documentation indicating it if the material is anionic or cationic type, N.Y.S.D.O.T. material designation grade, and test data shall be provided.

E. For the recycled concrete aggregate (RCA) the Contractor shall submit a sieve gradation for approval by the architect. Along with sieve, the Contractor shall submit documentation that the material to be provided will be obtained from a N.Y.S.D.E.C. registered or permitted construction and demolition (C & D) debris processing facility as specified in Section 360-16.1 of 6NYCRR Park 360 “Solid Waste Management Facilities.” If blast furnace slag is to be used, provide beneficial use determination (BUD) prior to its use as specified in the 6NYCRR par 360-1.15, “Solid Waste Management Facilities.”

F. It shall be the Contractors responsibility upon the initial delivery of the materials and during subsequent deliveries, to take samples for testing as described In Section 1.06 Quality Assurance. If for any reason the Owner or Architect shall request the material be tested, the Contractor shall provide the samples free of charge. If requested the Contractor shall also perform, free of charge, core samples of the constructed work for testing. All test results will be copied to the Contractor for their record.

G. Contractor shall provide written certification on their company letterhead that all installed asphalt was produced and installed in accordance with N.Y.S.D.O.T. specifications and guarantee work against structural and material defects for a period of one year from completion date.

1.05 QUALITY ASSURANCE (RCA SUB-BASE)

A. The Contractor is responsible to establish and maintain required design, grades, lines and elevations including crown and cross-slope of sub base course.

B. The Contractor shall be responsible for Quality Assurance as described in Section 321216 – 1.05 – Quality Assurance (RCA Subbase).

1.06 QUALITY ASSURANCE FOR HOT MIX ASPHALT (HMA)

A. All materials for hot mix asphalt (HMA) production, such as, aggregates, PG binder, reclaimed asphalt pavement (RAP), mineral filler, or any other materials shall meet N.Y.S.D.O.T. requirements.

B. The Contractor shall be responsible for hot mix asphalt (HMA) quality assurance is described in Section 321216 – 1.06 - Quality Assurance for Hot Mix Asphalt (HMA).

PART 2 – MATERIALS

2.01 ASPHALT TYPES

A. Removal and Replacement: N.Y.S.D.O.T. Type 3 binder and N.Y.S.D.O.T. Type 6 top coat.

B. Crack Repair: N.Y.S.D.O.T. type 5 asphalt shim.

2.02 ASPHALT FILLER

A. Filler shall be asphalt cements and shall meet the requirements in Table 702-2 Miscellaneous Asphalt Cements found at the end of this section.

B. The asphalt cement shall be homogenous, free from water, and shall not foam when heated.

2.03 ASPHALT EMULSIONS TACK COAT

A. The emulsion shall be homogeneous and show no separation of asphalt, after thoroughly mixing, within 30 days after delivery, provided separation has not been caused by freezing. Emulsified asphalts held in storage tanks, drums or distributors for long periods are subject to settlement. The asphalt emulsion shall be agitated or circulated amply to ensure emulsion prior to testing. Material that has separated due to freezing is unacceptable at anytime. Asphalt emulsions shall meet the requirements shown in Table 702-5 Anionic Asphalt Emulsions and Table 702-6 Cationic Asphalt Emulsions both can be found at the end of this section.

PART 3 – EXECUTION

3.01 REMOVAL AND REPAIR OF DETERIORATED ASPHALT PAVEMENT SECTIONS

A. Contractor shall remove and dispose of deteriorated section of HMA pavements to sound material to the extent indicated on the drawings, such that all excavated sides are vertical. Use a chipping hammer, a milling machine equipped with a means to suppress airborne particles, or other appropriate means. The perimeter of repair shall be saw cut at the full depth of the repair section. (Full depth shall mean pavement and 6” RCA subbase).

B. Tamp or roll existing subgrade and/or subbase as required.

C. Clean and dry all surfaces exposed from removal operation such that they are clean and free of dust and debris.

D. Uniformly apply asphalt tack coat emulsion to these surfaces as described in Section 321216 – Part 3 - Execution.

E. Place the HMA in the repair areas only when the ambient temperature is 45ºF or greater. The minimum HMA placement temperature shall be 250ºF.

F. If the total depth of the patch is greater than 3 inches, compact the HMA in multiple lifts, thoroughly compact the lower lifts with a mechanical tamper.

G. Use N.Y.S. type 3 for binder patch and type 6 for top course patch.

H. For the top lift, thoroughly compact with a steel wheel roller or pneumatic roller. Slightly overfill the patch with HMA such that the resulting patch is dense, smooth, and no more than 1/4” inch above the existing surface.

I. When placing the shim course to fill wheel ruts in existing pavement, each wheel path rut must be paved separately. This placement equipment will be a drag box configuration or approved equal having side forms. Use the equipment to spread and strike off the shim course material to a uniform width of approximately 4 feet. The intent of the operation is to fill the low area only and to place the material for the pavement’s full lane width. The placement equipment wheels and/or other appurtenances must not interfere with the distribution and placement of the shim course material.

3.02 CRACK SEALING JOINTS & CRACKS

A. For pavement that requires stress relieving repairs, repair as per N.Y.S.D.O.T. specification section 633-3.05 prior to joint or crack repair work.

B. Contractor shall use a compressed air stream of at least 80 psi gauge measured at the source to clean all unsealed and inadequately sealed joints and cracks.

C. Clean all joints and cracks in the pavement of all dirt and loose material to a depth equal to a minimum of twice the crack or joint width, by holding the cleaning jet one inch above the pavement surface. Old joint and crack sealer remaining after cleaning operations need not be removed.

D. Contractor shall keep the joint and cracks clean until the sealing, filling and paving operations are complete.

E. Joints and cracks less than ¼" are not required to be cleaned or sealed.

F. Seal joints and cracks in the existing pavement from ¼" to 1" wide with an approved asphalt cement filler. To ensure that space will be available for expansion of the asphalt filler when HMA is paved over the joint or crack, do not fill the joint or crack completely to the surface. Blot with fine (as per N.Y.S.D.O.T. Section 703-01) aggregate if required to prevent tracking the bituminous material over the paved surface.

G. Fill joints and cracks greater than 1" wide with N.Y.S.D.O.T. type 5 asphalt shim.

3.03 CLEANING AND PREPARATION OF PAVEMENT SURFACES FOR PAVEMENT MARKING

A. The Contractor shall select the materials and equipment for cleaning and preparing pavement surfaces.

B. When the work is conducted under traffic, the Contractor shall supply all necessary flags, markers, signs, and other devices to maintain and protect traffic.

C. Whenever grinding, water blasting, dry sandblasting or other operations are performed, the work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect the motorist.

D. When removal and cleaning operations are complete, the Contractor shall first power broom and then blow off with compressed air the pavement to remove residue and debris resulting from the cleaning work.

E. The Contractor shall conduct removal and cleaning work in such a manner as to minimize airborne dust, and similar debris so as to prevent a hazard to motor vehicle operation or nuisance to property.

F. Care shall be taken to prevent damage to transverse and longitudinal joint sealers.

G. Cleaning and surface preparation work shall be confined to the surface of existing pavement markings that are specified for removal on the plans or as directed by the Architect.

H. Pavement markings shall be cleaned to the extent that 95% to 100% of the existing marking is removed. Removal operations shall be conducted in such a manner that no more than moderate color and/or surface texture change results on the surrounding pavement surface.

3.04 CLEANING EXISTING PAVEMENT PRIOR TO ASPHALT OVERLAY

A. Clean existing pavement and shoulder surfaces to be overlaid, including ruts and depressions, by the use of mechanical sweepers, hand brooms, or other means until the surfaces are free of all material which might interfere with the bond between the overlay material and existing surfaces.

B. Remove all debris from the pavement surfaces and dispose of in an appropriate manner. Keep the pavement clean until the overlay operations are completed.

3.05 COMPLETION OF WORK

A. Once repair, sealing and pavement cleaning and preparation are complete, refer to construction documents for additional scope.

B. If additional work is required by the Contract refer to related sections for additional components.

END OF SECTION

TABLE 702-2 MISCELLANEOUS ASPHALT CEMENTS		
MATERIAL DESIGNATION	**702-0700**	
GRADES	**18 - 60**	
Test Requirements	**Minimum**	**Maximum**
Penetration, 77ºF (25ºC), 100 g, 5 second (AASHTO T 49)	18	60
Flash Point, COC, ºF (AASHTO T 48)	393	-
Solubility in trichloroethylene, % (AASHTO T 44)	99.5	-
Softening Point, ºF (AASHTO T 53)	130	167
Loss on Heating, 325ºF (163ºC), 5 hour, % (AASHTO T 47)	-	1.0
Penetration of Residue, % of Original (AASHTO T 49)	60	-
Ductility, 77ºF (25ºC), 5 cm/minute, cm (AASHTO T 51)	5	-
Typical Uses	Joint & Crack Filler	

TABLE 702-5 ANIONIC ASPHALT EMULSIONS																				
TYPE	**RAPID SETTING**								**MEDIUM SETTING**								**SLOW SETTING**			
MATERIAL DESIGNATION	702-3001		702-3002		702-3101		702-3102		702-3201		702-3301		702-3401		702-3402		702-3501		702-3601	
GRADE	RS-1		RS-1h		RS-2		HFRS-2		MS-2		HFMS-2		HFMS-2h		HFMS-2s		SS-1		SS-1h	
Test Requirements	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Emulsion: Viscoity, Saybolt Furol, 77ºF (25ºC), second	20	100	20	100	-	-	-	-	100	-	100	-	100	-	50	-	20	100	20	100
Viscoity, Saybolt Furol, 122ºF (50ºC), second	-	-	-	-	75	400	75(1)	400 (1)	100 (1)	400 (1)	100	400	-	-	-	-	-	-	-	-
Storage Stability Test, 1 Day **(Difference in % Residue)**	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
Demulsibility, 35 ml, 0.02 N, CaC12, %	60	-	60	-	60	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-
Cement Mixing Test, %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0 (4)	-	2.0 (4)
Sieve Test, %	-	0.10	-	0.10	-	0.10	-	0.1	-	0.1	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10
Residue by Distillation, %	55	-	55	-	63	-	63	-	65	-	65	-	65	-	65	-	57	-	57	-
Oil Distillate, Volume Total Emulsion, %	-	2	-	2	-	3	-	3	-	10	-	10	-	3	-	10	-	-	-	-
Residue from Distillation Test: Penetration, 77ºF (25ºC), 100 g, 5 second	100	200	40	90	100	200	100	200	100	200	100	200	40	90	200	-	100	200	40	90
Ductility, 77ºF (25ºC), 5 cm/minute, cm	40	-	40	-	40	-	40	-	40	-	40	-	40	-	40	-	40	-	40	-
Solubility in trichloroethylene, %	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-
Float Test[2], 140ºF (60ºC), second	-	-	-	-	-	-	1200	-	-	-	1200	-	1200	-	1200	-	-	-	-	-
Suggested Temperature Range: Mixing, ºF	-	-	-	-	-	-	-	-	100	170	100	170	75	170	75	170	75	140	75	140
Spraying, ºF	75	150	75	150	130	170	130	170	130	170	130	170	75	170	-	-	75	140	75	140
Typical Applications:[3]	Spray Patch		Tack Coat for HMA		Surface Treatment				Base and Shoulder Stabilization, Cold Mixes, Shoulder Seal				Hot & Cold Mixes		Stockpile Patching Mix		Base and Shoulder Stabilization			

Notes:

1. This viscosity requirement at 122ºF (50ºC) applies to emulsion used for shoulder sealing.
2. Float Test AASHTO T50, except that the residue from distillation shall be poured immediately into the float collar at 500ºF (260ºC).
3. These typical applications are intended only as a guide for selecting the proper emulsion grade.
4. The cement mixing test is waived if this grade of emulsion is used for stabilization.

TABLE 702-6 CATIONIC ASPHALT EMULSIONS																
TYPE	**RAPID SETTING**						**MEDIUM SETTING**				**SLOW SETTING**				**QUICK SETTING**	
MATERIAL DESIGNATION	**702-4001**		**702-4002**		**702-4101**		**702-4201**		**702-4301**		**702-4401**		**702-4501**		**702-4601**	
GRADE	**CRS-1**		**CRS-1h**		**CRS-2**		**CMS-2**		**CMS-2h**		**CSS-1**		**CSS-1h**		**CQS-1h**	
Test Requirements	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Emulsion: Viscoity, Saybolt Furol, 77ºF (25ºC), second	20	100	20	100	-	-	-	-	-	-	20	100	20	100	20	100
Viscoity, Saybolt Furol, 122ºF (50ºC), second	-	-	-	-	100	400	50	450	50	450	-	-	-	-	-	-
Storage Stability Test, 1 Day **(Difference in % Residue)**	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
Classification Test	Passes		Passes		Passes		---		---		---		---		---	
Particle Charge Test	Positive		Positive		Positive		Positive		Positive		Positive(1)		Positive(1)		Positive(1)	
Sieve Test, %	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10
Cement Mixing Test, %	-	-	-	-	-	-	-	-	-	-	-	2.0(3)	-	2.0(3)	-	-
Residue by Distillation, %	60	-	60	-	65	-	65	-	65	-	57	-	57	-	62	-
Oil Distillate, Volume Total Emulsion, %	-	3	-	3	-	3	-	12	-	12	-	-	-	-	-	-
Residue from Distillation Test: Penetration, 77ºF (25ºC), 100 g, 5 second	100	250	40	90	100	250	100	250	40	90	100	250	40	90	40	90
Ductility, 77ºF (25ºC), 5 cm/minute, cm	40	-	40	-	40	-	40	-	40	-	40	-	40	-	40	-
Solubility in trichloroethylene, %	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-
Suggested Temperature Range: Mixing, ºF	-	-	-	-	-	-	100	170	100	170	75	150	75	150	75	150
Spraying, ºF	75	140	75	140	130	170	130	170	130	170	75	150	75	150	-	-
Typical Applications:(2)	Spray Patch		Tack Coat for HMA		Surface Treatment		Cold Mixes				Base and Shoulder Stabilization				Quick-Set Slurry Seal	

Notes:

1. If the Particle Charge Test result is inconclusive, material having a maximum pH value of 6.7 will be acceptable.
2. These typical applications are intended only as a guide for selecting the proper emulsion grade.
3. The cement mixing test is waived if this grade of emulsion is used for stabilization.

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321216 – ASPHALT PAVING

PART 1 – GENERAL

1.01 GENERAL

A. GC shall be responsible for all work to be provided in conformance with sections referred to herein.

B. Drawings and General Provisions of the Contract and Supplementary conditions and Division 01 specification sections, apply to the work of this section.

1.02 SCOPE

A. The work of this section applies to all recycled concrete aggregate (RCA) sub-base and hot mix asphalt items in the contract. The work shall consist of preparing the existing subgrade material to receive the new RCA sub-base, as well as furnishing, mixing, spreading and compacting the RCA sub-base, dense asphalt binder course and the asphalt top course to the lines, grades, and dimensions shown on the plans and as specified herein.

B. Unless shown otherwise indicated on plans the new pavement system for roads and parking lots shall be as follows:

1. Recycled concrete aggregate sub-base course shall be 6” thick (compacted)

2. Dense asphalt binder course shall be 3 ½ inches (compacted), Type 3.

3. Asphalt top course shall be 1 ½ inches thick, Type 6F3.

C. Unless otherwise indicated on plans the pavement systems for tracks and tennis courts shall be as follows:

1. Tracks:

   a. Recycled concrete aggregate sub-base course shall be 6” thick (compacted).

   b. Dense asphalt binder course shall be 2 ½ inches (compacted) thick, Type 3.

   c. Asphalt top course shall be 1 ½ inches thick, Type 7.

2. Tennis Courts:

   a. Recycled concrete aggregate sub-base course shall be 6” thick (compacted), Type 1.

   b. Dense asphalt binder course shall be 2 ½ inches (compacted) thick, Type 3.

   c. Asphalt top course shall be 1 ½ inches thick, Type 7.

D. Unless otherwise indicated on plans, asphalt play surfaces and walks shall be 2” Type 7 asphalt over 6” RCA.

1.03 RELATED SECTIONS

A. Section 014523 – Tests, Inspections, and Special Inspections Quality Assurance Plan

B. Section 033000 – Cast-In-Place Concrete
C. Section 310000 – Earthwork
D. Section 310001 – Site Work General Provisions
E. Section 310002 – Stakeout
F. Section 312500 – Erosion and Sediment Controls
G. Section 320117 – Pavement Repair and Resurfacing
H. Section 321216.11 – Asphalt Overlay
I. Section 321723 – Pavement Markings
J. Section 334000 – Storm Drainage Utilities

1.04 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. For the recycled concrete aggregate (RCA) the Contractor shall submit a sieve gradation for approval by the architect. Along with sieve, the Contractor shall submit documentation that the material to be provided will be obtained from a N.Y.S.D.E.C. registered or permitted construction and demolition (C & D) debris processing facility as specified in Section 360-16.1 of 6NYCRR Part 360 “Solid Waste Management Facilities.” If blast furnace slag is to be used, provide beneficial use determination (BUD) prior to its use as specified in the 6NYCRR par 360-1.15, “Solid Waste Management Facilities.”

C. For the asphalt binder and top course, the Contractor shall submit to the Architect for approval, the job mix formula with current date, job location, asphalt plant, and contractor name. The type of asphalt and course shall also be stated. The job mix formula sheet shall indicate the gradations of the aggregates to be used in the mix along with the PGB content.

D. It shall be the Contractors responsibility upon the initial delivery of the materials and during subsequent deliveries, to take samples for testing as described In Section 1.06 Quality Assurance. If for any reason the Owner or Architect shall request the material be tested, the Contractor shall provide the samples free of charge. If requested the Contractor shall also perform, free of charge, core samples of the constructed work for testing. All test results will be copied to the Contractor for their record.

E. Contractor shall provide written certification on their company letterhead that all installed asphalt was produced and installed in accordance with these specifications and guarantee work against structural and material defects for a period of one year from completion date.

F. Interim and final as-built surveys; reference Quality Assurance section below and Specification Section 017839.

1.05 QUALITY ASSURANCE (RCA SUB-BASE)

A. The Contractor is responsible to establish and maintain required design, grades, lines and elevations including crown and cross-slope of sub base course.

B. An independent testing laboratory, selected and paid for by the Owner shall be retained to perform construction testing of the in place sub-base course, for compliance with the Contract Documents. The Contractor shall arrange for and schedule the testing. The sub-base course shall be checked for thickness and tolerance by rod and level readings on a 50 ft. grid or as directed by the Architect. Readings shall be to +0.05’ of design elevation that allow for asphalt thickness as shown on the Contract Documents. The Contractor shall at no cost to the Owner provide instruments personal and a suitable benchmark. Any deficiencies shall be corrected prior to proceeding with paving operations.
   1. Prior to paving parking lots or plaza areas greater than 10,000 sf, the contractor shall provide an interim topographical survey of the RCA Sub-base in the datum of the Construction

Documents for review for conformance by the Architect. Said survey is required to be performed a licensed land surveyor. Spot elevations on said survey shall be in complimentary locations to the Construction Drawings.

C. The following tests shall be performed on the sub-base material ASTM 1557 or ASTM D698 compaction test to determine % of compaction and molding water content needed to achieve the required engineering properties of the sub-base.

D. The following test shall be performed on the sub-base material ASTM D4318 determination of the liquid limit, plastic limit, and the plasticity index of soils.

E. In place sub-base material shall be tested in accordance with ASTM D1556 to determine the in place density and unit weight of soils using a sand cone apparatus, or ASTM D2167 to determine the in place density and unit weight of the compacted sub-base.

F. The sub-base material shall be compacted to not less than 98% of optimum density as determined by ASTM D698 or 95% as determined by ASTM D1557, unless otherwise indicated on the drawings.

G. The in place sub-base material shall be tested for thickness and compaction for each 5,000 square feet for jobs up to 20,000 s.f. and for each 10,000 s.f. for jobs larger than 20,000 s.f.

H. The independent testing laboratory shall prepare test reports that indicate test location, elevation data from a construction site benchmark, and test results. The Owner, Architect and Contractor shall all be provided with copies of reports within 96 hours of the time the test was performed. In the event that any test performed fails to meet these specifications, the Owner and the Contractor shall be notified immediately by the testing laboratory. It shall be the Contractor's responsibility to correct any non-conforming work at no additional cost to the Owner and pay for all additional testing by the independent testing laboratory to prove corrective work is in conformance with these specifications.

1.06 QUALITY ASSURANCE FOR HOT MIX ASPHALT (HMA)

A. All materials for hot mix asphalt (HMA) production, such as, aggregates, PG binder, reclaimed asphalt pavement (RAP), mineral filler, or any other materials shall meet the requirements of Section 2.

B. The Contractor shall be responsible for quality control (QC). QC is defined as all activities required to produce HMA that meets all specification requirements. The Contractor shall provide HMA and assume all responsibilities for all QC activities at the production facilities.

C. Methods of Sampling and Testing

1. All HMA material shall be sampled and the properties enumerated in these specifications shall be determined in accordance with the following methods, as currently revised.
   a. Sampling mineral aggregates ASTM: D-75
   b. Sampling bituminous mixtures ASTM: D-979
   c. Sieve analysis of aggregates ASTM: C-136
   d. Determination of bitumen content ASTM: D-1097
   e. Specific gravity of coarse aggregate ASTM: C-127
   f. Specific gravity of fine aggregate ASTM: C-128
   g. Sieve analysis of mineral filler ASTM: D-546
   h. Sampling bituminous materials ASTM: D-140
   i. Liquid limit, plastic limit & plasticity index ASTM: D-4318
   Or current applicable methods recommended by the American Association of State Highway Officials, and/or The Asphalt Institute.

D. The PG binder will be accepted on the basis of PG binder suppliers certification. The Contractor shall provide a copy to the Architect.

PART 2 – MATERIALS

2.01 COMPOSITION OF MIXTURES (RCA)

A. Recycled concrete aggregate sub-base.

1. Provide RCA which meets the specification material requirements and is within the Contractors capabilities to place and fine grade to the required tolerances.

2. Furnish materials of at least 95%, by weight, of recycled portland cement concrete aggregate (RCA), and free from organic and other deleterious material. This material may contain up to 5% by weight asphalt and/or brick.

3. Gradation for RCA shall conform to the following:

Sieve Size Designation	Percent Passing by Weight
4 inch	-
3 inch	100
2 inch	90 – 100
¼ inch	30 – 65
No. 40	5 – 40
No. 200	0 -10

4. Material will be accepted on the basis of magnesium sulfate soundness loss after four cycles of 20% or less. The required plasticity index of the material passing the No. 40 sieve is 5.0 or less.

5. A flat or elongated particle is defined herein as one which has its greatest dimension more than three times its least dimension. Provide material consisting of particles where not more than 30% by weight, of the particles retained on a ½ inch sieve are flat or elongated. Material with a percentage greater than 30 will be rejected.

2.02 COMPOSITION OF MIXTURES (HMA)

A. The HMA plant mix will generally be composed of a mixture of aggregate and reclaimed asphalt pavement (RAP), filler if required, and PG binder. For any HMA required by the plans, formulate a job mix formula that satisfies the general limits of Table 1. A copy of this table can be found at the end of this section. See section 1.02B for system components. For type 6F3 mixture, determine the optimum asphalt content for the proposed gradation using the Marshall mix design method (50 blows). The resultant mixture shall meet the following Marshall properties.

Mix Property	Type 6F3
Air Voids %	3.0 – 5.0
Voids in Mineral Aggregate	14
Voids filled with Binder VFB, %	65 - 78

Contractor shall produce, deliver to the work site, and incorporate the mixture into the work within the mixing and placing temperature range imposed by Table 1 Composition of Marshall designed plant mixtures. The plant mixed material will be accepted after blending and mixing at the plant. The pavement courses will be accepted after all paving operations are completed and certified by the Contractor.

B. Fine aggregate may consist of screenings, free from deleterious materials and manufactured from sources of stone, gravel, or slag.

C. Coarse aggregate will consist of crushed stone, crushed gravel or crushed slag.

D. When aggregates from approved natural fine sand sources are combined with coarse aggregates in the mixture, aggregate particles will meet additional requirements as follows:

    1. Particles in the No. 1A and No. 1 primary sizes will have a minimum of 85% by weight, of the particles with at least two fractured faces.

    2. Particles in the No. 2, No. 3 and No. 3A primary sizes will have a minimum of 75%, by weight, of the particles with at least one fractured face.

E. Coarse aggregate type 6F3 conditions:

    1. Limestone or a blend of limestone and dolomite having an acid-insoluble residue content of not less than 20%

    2. Dolomite

    3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.

    4. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore trailings, slag or other similar materials meeting the following requirements:

        a. (Type 6F3 Mixes) non-carbonate plus 1/8-inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes of materials of different specific gravities). Additionally, a minimum of 20% plus ¼ inch particles must be non-carbonate.

        b. When coarse aggregate for these mixes are from more than one source or of more than one type of material, proportion and blend them to provide a uniform mixture.

F. Performance Graded Binder. Unless the type of PG Binder is specified in the Contract Documents, use PG 64-22.

G. Reclaimed asphalt pavement (RAP) shall meet the requirements of a superpave hot mix asphalt mixture design and mixture verification procedures.

TABLE 1 COMPOSITION OF HOT MIX ASPHALT MIXTURES												
Mixture	**Base**				**Binder**		**Shim**		**Top3,4**			
Require-ments[1]	**Type 1**		**Type 2**		**Type 3**		**Type 5**		**Type 6, 6F2, 6F3**		**Type 7, 7F2, 7F3**	
Screen Sizes	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**
2 in	100	-	100	-	-		-	-	-	-	-	-
1 ½ in	90-100	-	75-100	±7	100	-	-	-	-	-	-	-
1 in	78-95	±5	55-80	±8	95-100	-	-	-	100	-	-	-
½ in	57-84	±6	23-42	±7	70-90	±6	-	-	95-100	-	100	-
¼ in	40-72	±7	5-20	±6	48-74	±7	100	-	65-85	±7	90-100	
1/8 in	26-57	±7	2-15	±4	32-62	±7	80-100	±6	36-65	±7	45-70	±6
No. 20	12-36	±7	-	-	15-39	±7	32-72	±7	15-39	±7	15-40	±7
No. 40	8-25	±7	-	-	8-27	±7	18-52	±7	8-27	±7	8-27	±7
No. 80	4-16	±4	-	-	4-16	±4	7-26	±4	4-16	±4	4-16	±4
No. 200	2-8	±2	-	-	2-8	±2	2-12	±2	2-6	±2	2-6	±2
PGB Content %[2]	4.0-6.0	0.4	2.5-4.5	0.4	4.5-6.5	0.4	7.0-9.5	0.4	5.4-7.0	NA	5.7-8.0	NA
Mixing &5 Placing Temp. Range, ºF	250-325		225-300		250-325		250-325		250-325		250-325	
Description and Typical Uses	Dense Base: For general use		Open Base: For permeable base layer		Dense Binder: Intermediate layer for general use		Shim: Fine HMA mixture for shimming ruts and leveling		Top Course: Dense course for single course resurfacing of rural, suburban, and urban roadways			

1. All aggregate percentages are based on the total weight of the aggregate.
2. The asphalt content is based on the total weight of the mix. When using slag aggregates in the mix, increase the PGB content accordingly, a minimum of 25% for an all slag mix.
3. 6F2, 6F3, 7F2, 7F3 mix types require friction coarse aggregates, and are required for mainline driving surface courses.
4. For Type 6 and Type 7 (F9) aggregate requirements, Marshall design will not be required. These mix types are suitable where the State's requirements for f9 aggregate apply.
5. Introduce the PG Binder into the pug mill between 225ºF and 350ºF, or as recommended by the PG Binder supplier.

2.03 TACK COAT

A. Tack coat shall meet the requirements of Tabe 2.

TABLE 2 – TACK COAT		
Test Requirements	Min	Max
Sieve Test, %	-	0.10
Residue by Distillation %	38	45
Oil Distillate, volume of total emulsion %	-	2
Test on Residue Distillation: penetration, 77ºF (25ºC), 100g, 5 second	40	90
Suggested spraying temp, ºF	75	150

B. Application of Emulsion Material

1. The asphalt emulsion contained in the distributor tank shall be homogenous. Emulsified asphalts held in storage tanks, drums, or distributors for long periods are subject to settlement. The asphalt emulsion shall be sufficiently agitated or circulated to ensure a homogenous emulsion prior to sampling or application.

PART 3 – EXECUTION

3.01 PREPARATION OF SUBGRADE

A. The subgrade surface is the surface of the pavement section upon which the select materials and/or sub-base are placed. The Contractor shall be responsible to cut and fill subgrade as required to achieve design grades. The subgrade area shall be prepared in conformance with Section 310000. It shall be the Contractor's responsibility to properly place and compact all materials in the road section and to correct any deficiencies resulting from insufficient or improper compaction of such materials throughout the Contract period. The Contractor shall determine the type, size and weight of the compactor best suited to the work at hand, select and control the lift (layer) thickness, exert control over the moisture content of the material, and other details necessary to obtain satisfactory results. The subgrade shall be compacted to density in accordance with section 310000 – Earthwork, but not less than 95% of modified proctor maximum dry density.

3.02 RCA SUBBASE

A. RCA subbase course shall be placed in conformance with Section 310000.

B. Contractor shall place RCA in a single layer with a minimum compacted layer thickness of 6 inches.

C. When the moisture content is within the limits for proper compaction, compact the material in accordance with the requirements of Section 310000.

D. If the subbase course is disturbed by frost action prior to paving, re-compact the subbase.

E. If, in the opinion of the Architect, the subbase is damaged or mixed with the subgrade or any other material due to the Contractor's operation the Contractor shall remove such material and replace it with the appropriate subbase at no additional cost to the Owner.

F. Place subbase so that after compaction the top surface of the course does not extend more than ¼" above nor more than ¼" below true grade for the course at any location.

3.03 CONDITIONS FOR PLACEMENT OF ASPHALTIC MATERIALS

A. Weather – Seasonal Limitations

1. The mixing and place of hot-mix asphalt shall be performed only when weather conditions are suitable. When pools of water are observed on the base, mixing and placing of hot-mix asphalt shall not be permitted. The temperature of the surface on which hot-mix asphalt is placed shall be as per Table 3.

2. Bituminous concrete pavement placed between November 30th and April 1st shall be subject to the following conditions and regulations:

    a. Approval of the Engineer.
    b. Compliance with Table 3 below.
    c. Acceptance of full responsibility by the Contractor for all work so placed.
    d. Providing for such guarantees and deposits as are required by Town regulations.
    e. Guarantee of all work so placed for a period extending up to one year. A notification from the Engineer before the end of the last month of the calendar year following shall be deemed to be within the period of guarantee.

TABLE 3 TEMPERATURE AND SEASONAL REQUIREMENTS		
Nominal Compacted Lift Thickness	**Surface Temperature (Minimum (Note 1)**	**Seasonal Limits**
≤ 1 in.	50ºF	(Notes 2 & 3)
1 in.<Thickness ≤ 3 in.	45ºF	(Notes 2 & 3)
>3 in.	40ºF	None

NOTES:

1. Measure all temperatures on the surface where the mixture is to be placed and the controlling temperature will be the average of three temperature readings taken at locations a minimum of 25 ft apart.
2. Unless otherwise authorized place Top Course only during the period of April 1st up to and including November 30th in the counties of Dutchess, Orange, Rockland, Putnam, Westchester, Nassau, Suffolk, and the City of New York.
3. Unless otherwise authorized place Top Course only during the period of April 15th up to and including October 31st in all counties except as required in Note 2.

3.04 TACK COAT

A. Apply a thin, uniform tack coat to surfaces of existing asphalt, Portland cement concrete layers including such areas as adjacent pavement edges, curbing, gutters, manholes, and other structures, immediately prior to place the HMA mixture against them.

B. Apply tack coat on the contact surfaces between all HMA pavement lifts prior to placing HMA mixture regardless of time period between lifts. The only exception to this is the surface of permeable base courses. Paving over a tack coat should not commence until the emulsion has broken (goes from brown to black) or is tacky when touched.

C. The tack coat shall be applied to a prepared clean pavement and in a manner to offer the least inconvenience to traffic and to reduce pickup or tracking of the bituminous material. Upon application the material shall be as uniformly spread across the width of the designated area.

D. The tack coat shall not be applied on a wet pavement surface or when the pavement surface temperature is below the temperature requirements outlined in Table 3 Temperature and Seasonal Requirements. To avoid “boil-off” of the water, the asphalt emulsion shall not be heated above 195ºF. The application rate shall be as determined in Table 4.

TABLE 4 TACK COAT APPLICATION RATES	
Surface Type	**Application Rate (gallons per square yard)**
New Hot Mix Asphalt	0.03 – 0.04
Milled Surfaces	0.05 – 0.06
Portland Cement Concrete	0.05 – 0.06
Vertical Surfaces (curbs, drainage structures, and appurtenances)	0.06-0.07

3.05 SPREADING AND FINISHING OF HMA

A. Lay the mixture upon an approved clean, tack coated surface. The only exception to this is the surface of permeable base courses. Spread and strike off to the established grade and elevation. Use HMA paver(s) to distribute the mixture either over the entire width or over such partial width as may be practicable. Upon arrival at the site, the trucks will dump the mixture into the paver. Immediately spread and strike off to the required width and appropriate loose depth to obtain the required compacted thickness at completion of the work.

B. When the initial pavement course is laid with automatic HMA pavers, guide the paver by a taut reference line positioned at or near the pavement centerline or edge. Erect and maintain the reference line. Support the reference line at approximately 25 foot intervals on tangent sections and at closer intervals on curves. Tension the line sufficiently to remove any sags. A moving reference of at least 30 ft. in length in lieu of a reference line may be used. The moving reference may be a floating beam, ski, or other suitable type such that the resulting pavement layer surface is sufficiently even. A short ski or shoe may also be used for the initial course if a satisfactory fixed reference such as a curb, gutter, or other fixed reference is adjacent to the pavement. When the proposed floating beam or the short ski does not produce the results similar to those obtained using a taut reference line, do not use these devices.

C. Place subsequent pavement courses over the initial course using one of the above methods. In addition, any course in an adjacent lane may be used as the reference for the use of a short ski.

D. The automatic screed controls will not be required where existing grades at roadway intersection or drainage structure must be met, for shoulders, temporary detours, behind curbs, or in other areas where its use is impractical.

E. If there are less than 1500 square yards in the Contract, or the areas to be paved are small and scattered, the HMA mixture may be spread by hand methods. For these areas, dump and spread the mixture such that the compacted thickness meets the specified thickness in the plans.

F. Prior to the beginning of rolling, check the loose mat, adjust any irregularities, and remove and replace all unsatisfactory material.

3.06 COMPACTION OF HMA

A. Immediately after the HMA mixture has been spread, struck off and surface irregularities adjusted, thoroughly and uniformly compact it by rolling. Roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. Initially roll all courses with the roller traveling parallel to the centerline of the pavement beginning at each edge and working toward the center. Roll banked curves starting at the low side edge and working toward the super elevated edge.

B. Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh mixture as required. Exercise care in rolling so as not to displace the line and grade of the edges of the HMA mixture. To prevent adhesion of the mixture to the drum(s) and pneumatic tires, keep the drum(s) and the pneumatic tires properly moistened with water or water mixed with small quantities of detergent or other approved material. Any petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use.

C. There shall be no visible defects, such as shallow ruts, ridges, roller marks, cracking, tearing, segregation, or any other irregularities as determined by the Architect, in the pavement when the rolling operation is complete. If these defects are present, correct these defects to the satisfaction of the Architect or remove & replace the pavement at no additional cost.

D. Along forms, curbs, headers, walls and other areas not accessible to the rollers, thoroughly compact the mixture with mechanical tampers. On depressed areas, use a trench roller or a small vibratory roller. Cleated compression strips may also be used under the roller to transmit compression to the depressed area.

E. Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective with fresh HMA mixture which shall be compacted to conform with the surrounding area. Correct any area showing an excess or deficiency of HMA material to the satisfaction of the Architect.

F. Compaction shall be per Three Roller Compaction Train

1. Initially roll all HMA mixtures with an approved steel-wheel roller operating in a static mode. Overlap the previous roller passes by one-half the width of the roller.
2. Immediately following the initial rolling, roll the mat with an approved pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.
3. Immediately following the intermediate rolling, finish roll the mat with a steel-wheel roller to remove all shallow ruts, ridges, roller marks and other irregularities from the surface.
4. Use this compaction method only when the compacted thickness of the finished mat is 4 inches or less. Unless approved by the Architect, the roller speeds shall not exceed 3 mph. when paving multiple lanes simultaneously; increase the required number of rollers proportionately for each additional full lane width unless otherwise permitted by the Architect.

G. The required number of passes listed in Table 5, Number of Passes, is recommended and may be increased as necessary to achieve adequate density.

TABLE 5 NUMBER OF PASSES

Pavement Courses	Three Roller Train (Static)	
	Steel Wheel Roller	Pneumatic Roller
Base (Open Graded Each Lift)	4	3
Base (Dense-Graded)	4	3
Binder (Dense-Graded)	2	3
Top (Dense-Graded All Types)	2	3

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321216.11 – ASPHALT OVERLAY

PART 1 – GENERAL

1.01 GENERAL

A. These specifications are intended to meet the latest edition of the N.Y.S.D.O.T. standard specifications U.S. Edition Section 403. It is the responsibility of the contractor to verify if the portions stated herein are current. This may be done by visiting the N.Y.S.D.O.T. website at: www.nysdot.gov/main/businesscenter/engineering/specificationssupdated-supdated-standard-specifications-us

B. GC shall be responsible for all work to be provided in conformance with sections referred to herein or within specification sections found on the N.Y.S.D.O.T. website.

C. Drawings and General Provisions of the Contract and Supplementary Conditions and Division 01 specification sections, apply to the work of this section.

1.02 SCOPE

A. Under this section the Contractor shall provide and install asphalt overlay over existing asphalt pavement that has been repaired as specified in Section 320117.

1.03 RELATED SECTIONS

A. Section 014523 – Tests, Inspections, and Special Inspections Quality Assurance Plan
B. Section 033000 – Cast-In-Place Concrete
C. Section 310000 – Earthwork
D. Section 310001 – Site Work General Provisions
E. Section 310002 – Stakeout
F. Section 312500 – Erosion and Sediment Controls
G. Section 320117 – Pavement Repair and Resurfacing
H. Section 321216 – Asphalt Paving
I. Section 321723 – Pavement Markings
J. Section 321723.11 – Pavement Markings (Thermoplastic)
K. Section 321723.12 – Pavement Markings (Pre-formed Reflectorized)
L. Section 334000 – Storm Drainage Utilities

1.04 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures.

B. For the asphalt, the Contractor shall submit to the Architect for approval, the job mix formula with current date, job location, asphalt plant, and contractor name. The type of asphalt and course shall also be stated. The job mix formula sheet shall indicate the gradations of the aggregates to be used in the mix along with the PGB content.

C. It shall be the Contractors responsibility upon the initial delivery of the materials and during subsequent deliveries, to take samples for testing as described in Section 1.06 – Quality Assurance. If for any reason the Owner or Architect shall request the material be tested, the Contractor shall provide samples free of charge. If requested the Contractor shall also perform free of charge, core samples of the constructed work for testing. All test results will be copied to the Contractor for their record.

D. Contractor shall provide written certification on their company letterhead that all installed asphalt was produced and installed in accordance with N.Y.S.D.O.T. specifications and guarantee work against structural and material defects for a period of one year from completion date.

1.05 QUALITY ASSURANCE FOR HOT MIX ASPHALT (HMA)

A. All materials for hot mix asphalt (HMA) production, such as, aggregates, PG binder, reclaimed asphalt pavement (RAP), mineral filler, or any other materials shall meet N.Y.S.D.O.T. requirements.

B. The Contractor shall be responsible for quality control (QC). QC is defined as all activities required to produce HMA that meets all specification requirements. The Contractor shall provide HMA and assume all responsibilities for all QC activities at the production facilities.

C. Methods of Sampling and Testing

1. All HMA material shall be sampled and the properties enumerated in these specifications shall be determined in accordance with the following methods, as currently revised.

   a. Sampling mineral aggregates ASTM: D-75
   b. Sampling bituminous mixtures ASTM: D-979
   c. Sieve analysis of aggregates ASTM: C-136
   d. Determination of bitumen content ASTM: D-1097
   e. Specific gravity of coarse aggregate ASTM: C-127
   f. Specific gravity of fine aggregate ASTM: C-128
   g. Sieve analysis of mineral filler ASTM: D-546
   h. Sampling bituminous materials ASTM: D-140
   i. Liquid limit, plastic limit & plasticity index ASTM: D-4318

   Or current applicable methods recommended by the American Associating of State Highway Officials, and/or the Asphalt Institute.

D. The PG binder will be accepted on the basis of PG binder suppliers certification. The Contractor shall provide a copy to the Owner.

PART 2 – MATERIALS

2.01 ASPHALT EMULSION TACK COAT

A. See Specification Section 320117 – Asphalt Repair, Crack Sealing & Cleaning/Preparation of Pavement Surface for Marking of these specifications.

2.02 HOT MIX ASPHALT OVERLAY

A. Hot mix asphalt overlay shall be N.Y.S.D.O.T. type 6F3 in parking areas and type 7 when overlaying play areas. The overlay compacted thickness shall be two inches.

2.03 COMPOSITION OF MIXTURES (HMA)

A. The HMA plant mix will generally be composed of a mixture of aggregate reclaimed asphalt pavement (RAP), filler if required, and PG binder. For any HMA required by the plans, formulate a job mix formula that satisfies the general limits imposed by N.Y.S.D.O.T. Table 403-1 Composition of Hot Mix Asphalt Mixtures latest version). A copy of this table can be found at the end of this section. For type 6F3 mixture, determine the optimum asphalt content for the proposed gradation

musing the Marshall mix design method (50 blows). The resultant mixture shall meet the following Marshall properties.

Mix Property	Type 6F3
Air Voids %	3.0 – 5.0
Voids in Mineral Aggregate	14
Voids filled with Binder VFB, %	65 - 78

Contractor shall produce, deliver to the work site, and incorporate the mixture into the work within the mixing and placing temperature range imposed by Table 403-1 Composition of Marshall designed plant mixtures. The plant mixed material will be accepted after blending and mixing at the plant. The pavement courses will be accepted after all paving operations are completed and certified by the Contractor.

B. Fine aggregate will consist of materials conforming to the requirements of Section 703-01 - Fine Aggregate of the N.Y.S.D.O.T. specifications. In addition, fine aggregate may consist of screenings, free from deleterious materials and manufactured from sources of stone, gravel, or slag meeting the requirements of N.Y.S.D.O.T. specification section 703-02, Coarse Aggregate.

C. Coarse aggregate will consist of crushed stone, crushed gravel or crushed slag conforming to the N.Y.S.D.O.T. requirements of section 703-02, Except for Gradation.

D. When aggregates from approved natural fine sand sources are combined with coarse aggregates in the mixture, aggregate particles will meet additional requirements as follows:

1. Particles in the No. 1A and No. 1 primary sizes will meet the quality requirements of N.Y.S.D.O.T. specification section 703-02 and will have a minimum of 85% by weight, of the particles with at least two fractured faces.

2. Particles in the No. 2, No. 3 and No. 3A primary sizes will meet the quality requirements of N.Y.S.D.O.T. section 703-02 and will have a minimum of 75%, by weight, of the particles with at least one fractured face.

E. Coarse aggregate type 6F3 conditions:

1. Limestone or a blend of limestone and dolomite having an acid-insoluble residue content of not less than 20%

2. Dolomite

3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.

4. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore trailings, slag or other similar materials meeting the following requirements:

   a. (Type 6F3 Mixes) non-carbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes of materials of different specific gravities). Additionally, a minimum of 20% plus ¼ inch particles must be non-carbonate.

   b. When coarse aggregate for these mixes are from more than one source or of more than one type of material, proportion and blend them to provide a uniform mixture.

F. Mineral filler if required in the mix to meet gradation requirements, shall conform to the requirements of the N.Y.S.D.O.T. specification section 703-08, Mineral Filler.

G. Performance graded binder (PG Binder) shall meet the requirements of the N.Y.S.D.O.T. specification section 401-2.04, Performance Graded Binder. Unless the type of PG Binder is specified in the Contract Documents, use PG 64-22, or a PG Binder specified in Table 6-4, Performance Graded Binder section of Chapter 6 of the Comprehensive Pavement Design Manual.

TABLE 403-1 COMPOSITION OF HOT MIX ASPHALT MIXTURES

Mixture	**Base**				**Binder**		**Shim**		**Top3,4**			
Require-ments[1]	**Type 1**		**Type 2**		**Type 3**		**Type 5**		**Type 6, 6F2, 6F3**		**Type 7, 7F2, 7F3**	
Screen Sizes	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**	**General limits % Passing**	**Job Mix Tol. %**
2 in	100	-	100	-	-		-	-	-	-	-	-
1 ½ in	90-100	-	75-100	±7	100	-	-	-	-	-	-	-
1 in	78-95	±5	55-80	±8	95-100	-	-	-	100	-	-	-
½ in	57-84	±6	23-42	±7	70-90	±6	-	-	95-100	-	100	-
¼ in	40-72	±7	5-20	±6	48-74	±7	100	-	65-85	±7	90-100	
1/8 in	26-57	±7	2-15	±4	32-62	±7	80-100	±6	36-65	±7	45-70	±6
No. 20	12-36	±7	-	-	15-39	±7	32-72	±7	15-39	±7	15-40	±7
No. 40	8-25	±7	-	-	8-27	±7	18-52	±7	8-27	±7	8-27	±7
No. 80	4-16	±4	-	-	4-16	±4	7-26	±4	4-16	±4	4-16	±4
No. 200	2-8	±2	-	-	2-8	±2	2-12	±2	2-6	±2	2-6	±2
PGB Content %[2]	4.0-6.0	0.4	2.5-4.5	0.4	4.5-6.5	0.4	7.0-9.5	0.4	5.4-7.0	NA	5.7-8.0	NA
Mixing &5 Placing Temp. Range, ºF	250-325		225-300		250-325		250-325		250-325		250-325	
Description and Typical Uses	Dense Base: For general use		Open Base: For permeable base layer		Dense Binder: Intermediate layer for general use		Shim: Fine HMA mixture for shimming ruts and leveling		Top Course: Dense course for single course resurfacing of rural, suburban, and urban roadways			

1. All aggregate percentages are based on the total weight of the aggregate.
2. The asphalt content is based on the total weight of the mix. When using slag aggregates in the mix, increase the PGB content accordingly, a minimum of 25% for an all slag mix.
3. 6F2, 6F3, 7F2, 7F3 mix types require friction coarse aggregates, and are required for mainline driving surface courses.
4. For Type 6 and Type 7 (F9) aggregate requirements, Marshall design will not be required. These mix types are suitable where the State's requirements for f9 aggregate apply.
5. Introduce the PG Binder into the pug mill between 225ºF and 350ºF, or as recommended by the PG Binder supplier.

PART 3 – EXECUTION

3.01 PREPARATION

A. In preparation for overlay Contractor shall repair existing pavement in accordance with Section 320117.

B. Contractor shall mill existing perimeter pavement not receiving overlay down to allow for a smooth consistent transition at intersections where new pavement meets old pavement. The milling shall be a minimum of 2'-0" wide.

C. Contractor shall mill existing pavement around the perimeter of storm water inlets as required to maintain existing storm water runoff patterns.

D. After repairing and cleaning of existing asphalt pavement contractor shall tack coat the entire asphalt area to receive asphalt overlay as described in Section 321216 – Part 3 – Execution.

3.02 CONDITIONS FOR PLACEMENT OF ASPHALTIC MATERIALS

A. Weather – Seasonal Limitations

1. The mixing and place of hot-mix asphalt shall be performed only when weather conditions are suitable. When pools of water are observed on the base, mixing and placing of hot-mix asphalt shall not be permitted. The temperature of the surface on which hot-mix asphalt is placed shall be as per Table 402-2.

2. Bituminous concrete pavement placed between November 30th and April 1st shall be subject to the following conditions and regulations:

   a. Approval of the Engineer.
   b. Compliance with Table 402-2 below.
   c. Acceptance of full responsibility by the Contractor for all work so placed.
   d. Providing for such guarantees and deposits as are required by Town regulations.
   e. Guarantee of all work so placed for a period extending up to one year. A notification from the Engineer before the end of the last month of the calendar year following shall be deemed to be within the period of guarantee.

TABLE 402-2 TEMPERATURE AND SEASONAL REQUIREMENTS

Nominal Compacted Lift Thickness	Surface Temperature (Minimum (Note 1)	Seasonal Limits
≤ 1 in.	50ºF	(Notes 2 & 3)
1 in.<Thickness ≤ 3 in.	45ºF	(Notes 2 & 3)
>3 in.	40ºF	None

NOTES:

1. Measure all temperatures on the surface where the mixture is to be placed and the controlling temperature will be the average of three temperature readings taken at locations a minimum of 25 ft apart.
2. Unless otherwise authorized place Top Course only during the period of April 1st up to and including November 30th in the counties of Dutchess, Orange, Rockland, Putnam, Westchester, Nassau, Suffolk, and the City of New York.
3. Unless otherwise authorized place Top Course only during the period of April 15th up to and including October 31st in all counties except as required in Note 2.

3.03 SPREADING AND FINISHING OF HMA

A. Lay the mixture upon an approved clean, tack coated surface. The only exception to this is the surface of permeable base courses. Spread and strike off to the established grade and elevation. Use HMA paver(s) to distribute the mixture either over the entire width or over such partial width as may be practicable. Upon arrival at the site, the trucks will dump the mixture into the paver. Immediately spread and strike off to the required width and appropriate loose depth to obtain the required compacted thickness at completion of the work.

B. When the initial pavement course is laid with automatic HMA pavers, guide the paver by a taut reference line positioned at or near the pavement centerline or edge. Erect and maintain the reference line. Support the reference line at approximately 25 foot intervals on tangent sections and at closer intervals on curves. Tension the line sufficiently to remove any sags. A moving reference of at least 30 ft. in length in lieu of a reference line may be used. The moving reference may be a floating beam, ski, or other suitable type such that the resulting pavement layer surface

is sufficiently even. A short ski or shoe may also be used for the initial course if a satisfactory fixed reference such as a curb, gutter, or other fixed reference is adjacent to the pavement. When the proposed floating beam or the short ski does not produce the results similar to those obtained using a taut reference line, do not use these devices.

C. Place subsequent pavement courses over the initial course using one of the above methods. In addition, any course in an adjacent lane may be used as the reference for the use of a short ski.

D. The automatic screed controls will not be required where existing grades at roadway intersection or drainage structure must be met, for shoulders, temporary detours, behind curbs, or in other areas where its use is impractical.

E. If there are less than 1500 square yards in the Contract, or the areas to be paved are small and scattered, the HMA mixture may be spread by hand methods. For these areas, dump and spread the mixture such that the compacted thickness meets the specified thickness in the plans.

F. Prior to the beginning of rolling, check the loose mat, adjust any irregularities, and remove and replace all unsatisfactory material.

3.04 COMPACTION OF HMA

A. Immediately after the HMA mixture has been spread, struck off and surface irregularities adjusted, thoroughly and uniformly compact it by rolling. Roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. Initially roll all courses with the roller traveling parallel to the centerline of the pavement beginning at each edge and working toward the center. Roll banked curves starting at the low side edge and working toward the super-elevated edge.

B. Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh mixture as required. Exercise care in rolling so as not to displace the line and grade of the edges of the HMA mixture. To prevent adhesion of the mixture to the drum(s) and pneumatic tires, keep the drum(s) and the pneumatic tires properly moistened with water or water mixed with small quantities of detergent or other approved material. Any petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use.

C. There shall be no visible defects, such as shallow ruts, ridges, roller marks, cracking, tearing, segregation, or any other irregularities as determined by the Architect, in the pavement when the rolling operation is complete. If these defects are present, correct these defects to the satisfaction of the Architect or remove & replace the pavement at no additional cost.

D. Along forms, curbs, headers, walls and other areas not accessible to the rollers, thoroughly compact the mixture with mechanical tampers. On depressed areas, use a trench roller or a small vibratory roller. Cleated compression strips may also be used under the roller to transmit compression to the depressed area.

E. Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective with fresh HMA mixture which shall be compacted to conform with the surrounding area. Correct any area showing an excess or deficiency of HMA material to the satisfaction of the Architect.

F. Compaction shall be per Three Roller Compaction Train

1. Initially roll all HMA mixtures with an approved steel-wheel roller operating in a static mode. Overlap the previous roller passes by one-half the width of the roller.

2. Immediately following the initial rolling, roll the mat with an approved pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.

3. Immediately following the intermediate rolling, finish roll the mat with a steel-wheel roller to remove all shallow ruts, ridges, roller marks and other irregularities from the surface.

4. Use this compaction method only when the compacted thickness of the finished mat is 4 inches or less. The roller speeds shall not exceed 3 mph. when paving multiple lanes simultaneously; increase the required number of rollers proportionately for each additional full lane width.

G. The required number of passes listed in Table 403-2, Number of Passes, is recommended and may be increased as necessary to achieve adequate density.

H. Seal joints between overlay and adjacent existing pavement with approved asphalt cement filler. Blot with find aggregate (as per N.Y.S.D.O.T. Section 703-01) if required to prevent tracking the bituminous material over the paved surface.

TABLE 403-2 NUMBER OF PASSES

Pavement Courses	Three Roller Train (Static)	
	Steel Wheel Roller	Pneumatic Roller
Base (Open Graded Each Lift)	4	3
Base (Dense-Graded)	4	3
Binder (Dense-Graded)	2	3
Top (Dense-Graded All Types)	2	3

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321236 – PAVEMENT SEALING

PART 1 – GENERAL

1.01 SCOPE

A. Under this section the Contractor shall seal coat pavement with GSB-88 ready to apply emulsified sealer/binder by Asphalt Systems, Inc. or approved equal.

1.02 RELATED SECTIONS

A. Section 320117 – Pavement Repair and Resurfacing
B. Section 321216 – Asphalt Paving
C. Section 321723 – Pavement Markings
D. Section 321723.11 – Pavement Markings (Thermoplastic)
E. Section 321723.12 – Pavement Markings (Pre-formed Reflectorized)

1.03 SUBMISSIONS

A. All submissions shall be made in accordance with section 013300 – Submittal Procedures.

B. Contractor shall submit manufacturer's product data and MSDS sheets.

1.04 QUALITY ASSURANCE

A. Do not apply to wet or damp pavement surfaces. Do not apply during rainy or damp weather, or when rain is anticipated within 8 hours after application is complete. Pavement surface temperatures should be 55ºF and rising before application. Do not apply on extremely windy days.

B. Parking areas with slopes of more than 5% and roadways shall have sand applied at time of application at a rate of 0.3 to 0.7 lbs/sq. yd.

PART 2 – MATERIALS

2.01 EMULSIFIED SEALER BINDER

A. In order to establish a standard of performance and quality, this specification is based on GSB-88 emulsified sealer binder as manufactured by Asphalt Systems Inc. (ASI). This does not preclude the contractor from submitting an "or equal." Coal Tar based sealers will not be accepted.

B. Sealer binder shall be a cationic stabilized emulsion of gilsonite ore and select plasticizers. Storage and handling shall be in accordance with manufacturers requirements

C. **Specifications for GSB-88 Ready-to-Apply are as follows:**

Saybolt Viscosity at 77ºF (25ºC) ASTM 0-244……..10 to 50 seconds
Residue by Distillation, or Evaporation……..28% to 42% min.
Pumping Stability Test (2)……. Pass

D. **Tests on Residue from Distillation, or Evaporation:**

Viscosity ASTM 275ºF (135ºC) ASTM 0-4402……1750 cts max.

Solubility in 1,1,1 trichloroethylene ASTM 0-2042……...97.5% min
Penetration ASTM 0-5……50 dmm max.
Asphaltenes ASTM 0-2007……15% min.
Saturates ASTM 0-2007……15% max.
Polar Compounds ASTM 0-2007……..25% min.
Aromatics ASTM 0-2007……15% min.

1. pH **may** be used in lieu of the particle charge test which is sometimes inconclusive in slow setting, bituminous emulsions.

2. Pumping stability is tested by pumping 1 pint, (475 ml) of GSB-88 diluted 1 part concentrate to 1 part water, at 77ºF (25ºC), through a ¼ inch gear pump operating 1750 rpm for 10 minutes with no significant separation or coagulation.

PART 3 – EXECUTION

3.01 PAVEMENT REPAIR

A. If repair is indicated, Contractor shall repair pavement as per Specifications Section 320117, prior to application of seal coat.

3.02 CLEANING & PREPARING

A. Contractor shall thoroughly clean the entire area to be seal coated. The surface of the area to be seal coated must be free of vegetation, dirt, oil, and other foreign materials.

B. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area being sealed with plastic or building felt and remove the covers each day.

C. The Contractor shall select the materials and equipment for cleaning and preparing pavement surfaces.

D. When the work is conducted under traffic, the Contractor shall supply all necessary flags, markers, signs, and other devices to maintain and protect traffic.

E. Whenever grinding, water blasting, dry sandblasting or other operations are performed, the work shall be conducted in such a matter that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect the motorist.

F. When removal and cleaning operations are complete, the Contractor shall first power broom and then blow off with compressed air the pavement to remove residue and debris resulting from the cleaning work.

G. The Contractor shall conduct removal and cleaning work in such a manner as to minimize airborne dust, and similar debris so as to prevent a hazard to motor vehicle operation or nuisance to property.

H. Care shall be taken to prevent damage to transverse and longitudinal joint sealers.

I. Cleaning and surface preparation work shall be confined to the surface of existing pavement markings that are specified for removal on the plans or as directed by the Architect.

J. Pavement markings shall be cleaned to the extent that 95% to 100% of the existing marking is removed. Removal operations shall be conducted in such a manner that no more than moderate color and/or surface texture change results on the surrounding pavement surface.

3.03 APPLICATION OF SEAL COAT ON SURFACES

A. Application of seal coating over surfaces that were recently patched will need to be done 15 days after patch was complete to allow asphalt to cure. New paved surfaces will require at least 30 days of cure time prior to seal coating.

B. Apply seal coating in a uniform manner to provide a constant, adherent coating. For bidding purposes; base on application rate of 0.15 gals/sy, one coat.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321640 – GRANITE CURBS

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 310000 – Earthwork

1.02 SUBMITTALS

A. Samples:

1. Granite Curb: Minimum one (1) foot long section.

2. Supplier and source.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Stone: Granite shall be tough, dense, sound and durable, of uniform light color, reasonably fine grained and free from seams, cracks or other structural defects.

B. Granite Curbs:

1. Furnish curbs with sawed top, split face and ends. Straight pieces shall be a minimum of 3 feet long. Curb segments on curves with radius of 100 feet or less shall be shaped to the required curvature, with the ends split on radial lines.

2. Indicated dimensions for curb segments shall not vary more than 2 inches for depth and 1 inch for width.

3. Top and front surfaces shall be true planes at right angles to each other, as seen with a straight edge. No projection greater than 3/4 inch or depression greater than 1/2 inch on the split surfaces will be acceptable. Top surface shall not vary more than 1/8 inch.

4. Drill holes will not be permitted in exposed curb surfaces.

C. Dry Concrete: One part Portland cement mixed with six parts DOT No. 1A coarse aggregate dry mix.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set curbs true to line and grade on a foundation of one cubic foot of dry concrete for each linear foot of curb installed. Fill voids to completely support entire length of curb.

B. Butt joint curb sections together, tight.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321723 – PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Under this work, the Contractor shall furnish and apply pavement marking paint at locations in accordance with the patterns indicated on the plans or as directed by the Architect, and in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and these specifications.

B. This work shall also include the cleaning and preparation of pavement surfaces and the maintenance and protection of traffic markings during marking operations.

1.02 REFERENCE STANDARDS

A. New York State Department of Transportation (NYSDOT)

B. Manual on Uniform Traffic Control Devices (MUTCD)

C. New York State Department of Environmental Conservation (NYSDEC)

D. United States Environmental Protection Agency (USEPA)

1.03 RELATED SECTIONS

A. Section 320117 – Pavement Repair and Resurfacing
B. Section 321216 – Asphalt Paving
C. Section 321216.11 – Asphalt Overlay

1.04 SUBMISSIONS

A. All submissions shall be made in accordance with Section 013300 – Submittal Procedures, and as modified below.

B. Contractor shall submit manufacturer's product data and color samples for every type of paint that is being used. Data shall include application rate, product characteristics, performance characteristics, composition information and product description.

C. For each paint being used, submit material safety data sheets.

PART 2 – MATERIALS

2.01 MATERIALS

A. For purposes of establishing a standard of quality, traffic paint shall be Sherwin-Williams Company Baltimore, MD Hotline® Fast Dry Latex Waterborne Traffic Marking Paint - TM2152 (white), TM2153 (yellow), TM2221 (black), TM2222 (red), TM2224 (blue) and TM2226 (green), or Architect approved equal. Any paint on the NYSDOT approved list for pavement marking materials may be permitted as an equivalent with Architects approval.

B. All paints shall conform to Federal, State, and local air pollution regulations including those for the control (emission) of volatile organic compounds (VOC) as established by the USEPA and the NYSDEC.

PART 3 – EXECUTION

3.01 APPLICATION CONDITIONS

A. At the time of paint application, the pavement surface and ambient temperature shall not be less than 50ºF, the relative humidity shall not exceed 85% and the pavement surface shall be cured and dry.

B. Traffic paint shall not be applied during periods of rain or if the rain is imminent. Waterborne traffic paint shall not be applied if rain is expected within 4 hours after application.

C. Paint shall be applied in strict accordance with the manufacturer's recommendations for use. In no case shall the paint be heated above 150ºF.

D. The Contractor shall be responsible for cleaning the pavement of dust, dirt and other foreign material which may be detrimental to the adhesion of the paint film in accordance with the manufacturer's requirements and to the satisfaction of the Owner and Architect.

3.02 APPLICATION

A. All pavement markings and patterns shall be applied in accordance with manufacturer's instructions and placed as shown in the Contract Documents. Installation shall also be in accordance with the MUTCD and the NYS Uniform Code and shall be as follows:

1. Parking stall stripes shall be 4" wide white except handicapped stalls and access aisles which shall be 4" wide blue.

    a. Uniform symbol of accessibility shall be blue.

    b. Hatching for handicap access aisles shall be 8" wide blue and set 3ft. on center.

    c. Hatching for other non-handicap areas as shown on the plans shall be 8" wide white and set at 3ft. on center.

2. Crosswalks shall have 8" wide white stripes at borders with 12" wide white lines perpendicular to boards and set 3ft. on center.

3. Stop lines shall be 2ft. wide white stripe.

4. Barrier lines shall be 4" wide yellow.

5. Edge of lane lines shall be 4" wide white stripes.

6. Directional arrows, letters, etc. shall be color and size as depicted on plans.

7. GC shall contact the local Fire Marshall and provide fire zone markings as required.

B. Certain products may require thermoplastic markings for certain specific components. If required, this will be indicated on the drawings.

C. When pavement markings are applied under traffic, the Contractor shall provide all the necessary flags, signs, cones, shadow vehicles, flashing arrow boards, etc. to maintain and protect traffic, to

protect the work operation, and to protect the painted pavement markings until thoroughly dry and serviceable.

D. The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of the normal flow of traffic shall not be allowed.

E. The painted pavement markings shall be uniformly applied to the pavement surface at a 15 mil wet film thickness or as per manufacturer's recommendation. The applied pavement markings shall have clean-cut edges and true and smooth alignment.

F. The Contractor shall repair and or replace any markings damaged during the performance of the work.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321913.14 – PLAYGROUND SYNTHETIC GRASS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work of this specification section includes all necessary material components and labor required to install the synthetic grass surfacing system as indicated on the drawings.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. *Turf Tek USA, 'Playground Extreme'*, is specified as a basis of design, quality, and layout. The specifications and drawings define and show the material or manufacturer as specified. It is not the intent to discriminate against any product of another manufacturer.

2. Installer Qualifications: Utilize an installer approved and trained by the manufacturer of the surfacing system, having experience with other projects of the scope and scale of the work described in this section. Provide written certification from the manufacturer that the installer is an approved applicator of the surfacing system. Submit written certification.

B. Design and Detailing:

1. Acceptable substrate and substrate systems are asphalt, concrete, and compacted crushed stone. For the purposes of this project, crushed stone (RCA) will be utilized.

2. Conditions of all substrates with respect to structural performance shall be evaluated and approved by the Architect prior to applying the *Synthetic Grass System*.

3. References:

a. American Society for Testing and Materials (ASTM):

1) ASTM D2434 AND D4716 – With respect to the base / pad.
2) ASTM F1292 - Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
3) ASTM F1951 - Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
4) ASTM F1551 – Standard Test Methods for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials.
5) ASTM F2765 – Standard Specification for total Lead Content in Synthetic turf Fibers.

1.03 SUBMITTALS

A. Before delivery to the job site, the Contractor shall submit samples of the *Synthetic Grass System* and associated components and technical data for approval by the Architect.

B. Submit manufacturer's product data, including installation instructions, ASTM F 1292 test results, ASTM F1951 Accessibility test results, ASTM F2075 test results, and IPEMA Certificates of Compliance where applicable.

C. Verification Samples: Submit manufacturer's standard verification samples of 9" x 9", minimum size.

D. Quality Assurance/Control Submittals: Submit the following: Certificate of qualifications of the surfacing installer.

E. General: Submit listed submittals in accordance with Conditions of the Contract, and Division 01 Submittal Procedures Section.

F. Closeout Submittals: Submit all warranty documents specified herein.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered in good condition in original unopened packages with labels intact.

B. Storage and Protection: Store all materials protected from weather and exposure to harmful environmental conditions and at a minimum temperature of 40°F (4°C), and a maximum temperature of 90°F (32°C). At all times, product adhesives shall be stored in temperatures of 40°F or higher.

1.05 PROJECT / SITE CONDITIONS

A. At the time of application ambient air temperature shall be 40°F (4°C) or greater and remain so for at least 72 hours after completion. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40°F (1°C), and maximum ambient temperature is 90°F (32°C).

B. All materials shall be protected from weather and other damage prior to application, during application, and while curing.

1.06 ALTERNATES AND ALLOWANCES

A. Systems to be considered as equal shall be approved by the Architect in writing prior to the bid date. All anticipated substitutions shall be submitted with all technical data necessary for the Architect's review to judge equivalency. Substitutions of the specified product will not be considered after the bid opening.

PART 2 - MATERIALS

2.01 GENERAL – SYNTHETIC GRASS SURFACING SYSTEM

A. All material components of the system shall be obtained by *Turf Tek USA,* www.turftekusa.com, (631) 651-5777.

2.02 MATERIALS

A. Resilient foam base: Polygreen Foam Pro.

1. Composition: Thermal Bonded, closed-cell, cross-linked, polyethylene foam (PEX), permanently fused together.

2. Top surface: each piece covered with one layer of non-woven geotextile fabric that is thermally bonded to the foam.

3. Recycled Content.

4. Size: 48 inches by 92 inches.
5. Weight: 20 lbs.
6. Thickness: 0.75 inch.
7. Impact Attenuation: ASTM F 1292. Meets criteria.
8. Permeability: ASTM F1551 59.9 (gal/min/yd2).
9. Permeability: ASTM F1551 183.7 (in/hr).

B. Synthetic Grass: Playground Extreme

1. Composition: 100% Polyethylene yarn and polyurethane backing.
2. Primary Yarn Polymer - Nylon.
3. Yarn Cross Section - Diamond; Color, Green Blend.
4. UV Stabilized – Yes.
5. Fabric Construction - Tufted.
6. Secondary Yarn Polymer Thatch - Polyethylene yarn, Secondary Yarn Color - Turf Green.
7. Face Weight – 72 oz/yd 2
8. Pile Height – 1.125”
9. Primary Backing – 7.1 oz/yd 2, Stabilized multi-layer woven polypropylene.
10. Secondary Backing – Urethane, 20 oz/yd 2.
11. Tufting Gauge – 1/4” o.c.
12. Fiber Mass – 10,000 Denier, 5,000 Denier Thatch.
13. Sustainability – 100 percent Recyclable.
14. Compliance: Meet or exceed CPSC guidelines for impact attenuation.
15. Warranty Period - 10 years- See warranty for details.
16. Accessibility: ASTM F1951 - Meets criteria.

C. Geotextile drainage fabric: In accordance with Specification Section 334000, or as recommended by manufacturer.

D. Recycled Plastic Lumber: 1” x 3” (3/4” x 2 5/8”) American Plastic Lumber, Inc. or approved equivalent.

E. Compacted Stone Base Course: In accordance with Specification Section 310000.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to application of the Synthetic Grass System, the applicator shall evaluate the substrate's structural performance, and verify that the conditions are acceptable to receive primary products of this Section. Notify the Architect of all discrepancies.

B. Work shall not proceed until unsatisfactory conditions are corrected. Do not proceed with surfacing installation until all applicable site work, including substrate preparation, drainage, fencing, equipment installation and other relevant work, has been completed, and until unsuitable conditions are corrected.

3.02 INSTALLATION

A. Install system in accordance with the Manufacturer’s written instructions.

3.03 PROTECTION

A. Protect the installed surface from damage resulting from subsequent construction activity on the site.

3.04 WARRANTY

A. The synthetic grass system shall be warranted by the manufacturer for any defects in material and workmanship for a period of three (3) years from date of purchase.

B. Submit, for Owner’s acceptance, the manufacturer’s standard warranty document executed by authorized company officials. Manufacturer’s warranty shall be in addition to, and not a limitation of, other rights the Owner may have under the contract documents.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 323113 – VINYL COATED CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.02 SUMMARY

A. The work includes all labor, materials, equipment, and appliances necessary to furnish and install the various height chain link fences and gates as shown on the plans, detailed in the specifications, and directed by and to the approval of the District.

1.03 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete
B. Section 310000 – Earthwork
C. Section 310001 – Site Work General Provisions
D. Section 329200 – Turf and Grasses

1.04 SUBMITTALS

A. Comply with the requirements of Section 013300 and as modified below.

B. Manufacturer's Data:

1. Submit copies of manufacturer's product data, specifications, installation instructions, and copy of manufacturer’s warranty.

C. Shop Drawings: Layout of items with dimensions, details, recommended footing details, finishes of components, and accessories.

PART 2 - MATERIALS

2.01 FENCE MATERIALS

A. Fabric: The fabric shall have knuckled edges at the top and bottom and shall be fastened to the top rail, and bottom rail when provided, which shall be run through loop caps.

1. PVC coating bonded and thermally fused to metallic coated steel core wire: ASTM F668 Class 2b, 7 mil thickness. Core wire tensile strength 75,000 psi. 2" diamond mesh, 9-gauge core wire with a diameter of 0.148" and a breakload of 1,290 lbs except where noted differently on the plans.

B. Posts: Line, terminal (corner and end), and gate posts shall be a minimum of 3'-8" greater in length than the fabric height in order to be embedded in 3'-6" deep concrete footings.

1. Line Posts: Line posts shall be 2.5 inch O.D. steel pipe, weight 3.65 lbs. per foot, copper bearing and hot dip galvanized; PVC-Coated finish in accordance with ASTM F1043;

supplemental color coating of 10-15 mils of thermally fused PVC in color as selected by the Architect. Complete with all necessary fittings.

2. Terminal Posts: End and corner posts shall be 3.0-inch O.D. steel pipe, weight 5.79 lbs. per foot, copper bearing and hot-dip galvanized; PVC-Coated finish in accordance with ASTM F1043; supplemental color coating of 10-15 mils of thermally fused PVC in color as selected by the Architect. Complete with all necessary fittings.

3. Gate Posts: Gate posts shall be copper bearing steel, hot-dip galvanized; PVC-Coated finish in accordance with ASTM F1043; supplemental color coating of 10-15 mils of thermally fused PVC in color as selected by the Architect. Complete with all necessary fittings. Conforming to the following sizes, except where noted differently on the plans:

   a. Gate leaf up to 3 ft. wide: Schedule 40, 2.875" o.d., 5.79 lbs. per lineal foot.

   b. Gate leaf over 3 ft. to 5 ft. wide: Schedule 40, 4.0" o.d., 9.10 lbs. per lineal foot.

   c. Gate leaf over 5 ft. to 10 ft. wide: Schedule 40, 6.625" o.d., 18.97 lbs. per lineal foot.

C. Gates: Gate frames shall be 2.0-inch O.D., copper bearing fabric to match the fence line. All frames shall be hot-dipped, galvanized 1.8 oz. zinc/s.f. uncoated surface, conforming to ASTM 120, Schedule 40. PVC-Coated finish in accordance with ASTM F1043; supplemental color coating of 10-15 mils of thermally fused PVC in color as selected by the Architect. All gates to be provided with necessary hinges and gate padlock fittings. Provide diagonal bracing when gate leafs are over 4'-0" wide.

D. Bracing: Braces not less than 1 5/8-inch O.D., weighing not less than 2.27 lbs. per foot, or approved equivalent section, complete with 3/8-inch galvanized truss rod and turnbuckle, all PVC coated, shall be installed at all corner, end, and gate posts, and as required at changes of vertical grade.

E. Post Tops: All posts shall be fitted with heavy malleable iron or pressed steel tops, PVC coated. Tops shall permit passage of top rails.

F. Bottom Rail: Bottom shall be 1 5/8-inch O.D., copper bearing steel pipe, hot-dipped, galvanized, weight 2.27 lbs. per foot. PVC-Coated finish in accordance with ASTM F1043; supplemental color coating of 10-15 mils of thermally fused PVC in color as selected by the Architect. Bottom rail shall be installed between posts with appropriate fittings and accessories.

G. Top Rail: Top rail shall be 1 5/8-inch O.D., copper bearing steel pipe, hot-dipped, galvanized, weight 2.27 lbs. per foot. PVC-Coated finish in accordance with ASTM F1043; supplemental color coating of 10-15 mils of thermally fused PVC in color as selected by the Architect. Top rail shall pass through the line post tops and form a continuous brace from end to end of each run of fence. Couplings shall be outside sleeve type and at least seven inches long; one coupling every five shall contain a heavy spring to take up expansion and contraction of the top rail.

H. Truss Rods: Galvanized steel rods, 5/16" min. diameter.

I. Tension (stretcher) bars: one piece lengths 2" shorter than fabric height, 3/16" x 3/4", hot dip galvanized, PVC coated.

J. Wire ties and clips: 9-gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12 1/2 gauge for attachment of fabric to tension wire. All PVC coated

K. Nuts and bolts are galvanized but not vinyl coated. Utilize PVC paint color coat nuts and bolts.

L. Fence Post Footings:

1. The line, corner, and end gate posts shall be as detailed on the plans. All concrete footings shall be 3,000 psi., air-entrained. Footings shall be crowned to shed water and protect posts at ground line.

a. If footings are not detailed on plans, they shall be provided with a diameter 4 times greater than the outside dimension of post, 3'-6" deep, or deeper as the post condition warrants.

2.02 TENNIS COURT WINDSCREEN

A. Provide tennis court windscreens at full perimeter of tennis courts if the work of this section is related to tennis court construction as indicated on the drawings.

1. Manufacturer: Douglas Industries, Eldridge, Iowa.

a. Model: VCP-9 Windscreen

2. Fabric:

a. Open mesh vinyl-coated (50%) polyester with 70% windbreak, 320 x 200 tensile strength, 9 x 12 inch weave, 7 oz. per square yard. Color as selected by Architect.

b. 3 ply hems, vinyl coated polyester reinforced and double sewn with heavy duty polyester thread.

c. No. 2 brass grommets.

d. Douglas AVR reinforced, die-cut, heat sealed air vents.

3. Fasteners:

a. Lightweight, self-locking plastic fasteners with 150lb. break strength, C-snaps, and lacing cord.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

3.02 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F567 and manufacturer's instructions.

B. Concrete Set Posts: Drill hole in firm, undisturbed earth to approximately 6" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.

1. Line posts shall be spaced at uniformly at approximately 8 ft. o.c., maximum of 10'-0" o.c., unless otherwise noted.

2. Terminal posts shall be located at each fence termination and change in horizontal or vertical direction of 30 degrees or more.

    a. Install horizontal pipe brace at mid-height for fences 6’ and taller, at first section on each side of terminal, corner, and gate posts. Firmly attach with appropriate fittings. Install diagonal truss rods at these points. Install braces and adjust truss rod, ensuring posts remain plumb.

C. Check each post for vertical and top alignment and maintain in position during placement and finishing operation.

D. Rails: Continuous top rails in 21 ft. sections. Bottom and mid rails (if required), single lengths between posts.

    1. Install mid-rails for fabric heights of 10 ft. and over.

E. Gates: Install gates plumb, level and secure for full opening without interference. Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on secure side and attach so that fabric remains in tension after pulling force is released. Leave approximately 1" between finish grade and bottom selvage. Attach fabric with 9 ga. galvanized PVC coated wire ties or clip to line posts at 12" on center and to rails, braces, and tension wire at 12" on center.

B. Tension (stretcher) bars): Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands spaced maximum of 15" on center.

3.04 ACCESSORIES

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on fence side opposite fabric side for added security.

3.05 CLEANING

A. Clean up debris and unused material and remove from site.

3.06 RESTORATION

A. Any areas of the project site that are disturbed by the work shall be restored to the condition in which they existed prior to this work.

B. Grass areas disturbed by this work shall be restored with topsoil & seed.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 323119 – DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of ornamental iron fencing and gates is shown on the drawings.

1. Fabrication.

2. All necessary hardware.

3. Finishes.

4. Installation.

1.02 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete
B. Section 310000 – Earthwork
C. Section 310001 – Site Work General Provisions
D. Section 310002 – Stakeout
E. Section 329200 – Turf and Grasses
F. Section 042000 – Unit Masonry
G. Section 055000 – Metal Fabrications

1.03 DESIGN REQUIREMENTS

A. Solid iron fencing and gates. Tubular members are specifically disallowed except where necessary as structural members, line posts, or as otherwise indicated on the drawings.

B. Materials shall be new stock, free from defects impairing strength, durability or appearance and of best commercial quality for each intended purpose. All steel to be pre-straightened with no curves or deformities and shall be straight within 1/8" overall from end to end in the finished product. All pickets parallel to end picket within 1/8" and all spaces equal to one another (MAXIMUM allowable deviation in all spaces, 1/16"). Frames and horizontal must be parallel to each other within 1/16" and jointed 90˚ ± 1˚ outside frame tolerance. Fence panel height ± 1/8" of shop drawings and ± 1/16" overall length dimension submitted on shop drawings. Diagonal measurements of each panel to be ±1/8" to each other on any single panel.

1.04 REFERENCED STANDARDS

A. ASTM A36 – Steel Plates, Shapes Tubes and Bars.
B. AWS – American Welding Society.
C. AISC – American Institute of Steel Construction.
D. SSPC – Steel Structures Painting Council.
E. SAE – Society of Automotive Engineers, Inc.

1.05 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings of all fencing and accessories in accordance with the requirements of

the General Provisions.

2. Construction Drawings indicate minimum design intent. Shop Drawings for gates, hinges, hinge posts, piers, and footings shall be signed and sealed by a licensed professional engineer.

B. Samples:

1. Submit samples of items requested to illustrate fabrication, detail, and finish, as per the requirements of the General Provisions.

2. Identify all samples completely describing material, gauges, treatment, texture, finish, and color.

1.06 EXAMINATION AND COORDINATION

A. The Contractor's attention is directed to the other specification sections to ascertain the scope of reinforcing, supporting, and attachment to other materials. Supplementary parts necessary to complete each item of miscellaneous metals, though such parts are not shown or specified, shall be included.

B. Examine all surfaces to which this work is to be attached. Notify the Architect if any conditions exist which are detrimental to the proper and timely installation of this work.

C. Cooperate in the coordination and scheduling of the work of this section with the work of other trades. Anchors, sleeves, framing, fastenings, and other miscellaneous items to be embedded in concrete or masonry, or required for securing wrought iron work to other construction, shall be furnished by the fencing contractor as required so as not to delay the progress of the work.

D. Verify, by measurements at the job site, all dimensions affecting this work. Field dimensions, which are at variance with those on the approved shop drawings, shall be brought to the attention of the General Contractor. Starting of work will be construed as acceptance of surfaces.

E. Furnish all necessary templates and patterns required by other sections.

F. Deliver, receive, handle, store and distribute all materials to prevent damage, deterioration or delay. Remove defective materials from project site within 24 hours.

G. Examine site topography and fabricate components accordingly, with raked panels or extended picket bottoms to maintain an approximate 4" ground clearance. All such specialty panels and components shall be indicated on the shop drawings.

PART 2 - MATERIALS

2.01 MANUFACTURER

A. Cassidy Brothers Forge, Inc, Rowley, Massachusetts, (978) 948-7303.

1. Fence: Unless specifically detailed or called for on the construction drawings, assume the Berkeley style for bidding purposes.

2. Gate: Unless specifically detailed or called for on the construction drawings, assume the Huntington style modified to match Berkeley for bidding purposes.

B. Substitutions shall be permitted only after receiving written approval from the Architect.

2.02 STEEL AND IRON

A. Steel plates, shapes, and bars, ASTM A36.

B. Tubing: Hot-rolled, ASTD A501 or cold-rolled, ASTM A500.

C. Gray Iron Castings – ASTM A48, Class 30.

2.03 HARDWARE

A. Hinges: Size and material to suit gate sizes, stainless steel pins with bronze bushings, non-lift off type, offset where required to permit 180˚ opening.

B. Hinge Posts: For gate leafs over 6'-0" wide, provide tubular steel superstructure to be embedded in concrete pier/footing, and encased in masonry, size as engineered for weight of gate.

C. Finish Hardware: Where indicated, provide stainless steel, exterior grade exit devices, with lock cylinders on secure side, keyed alike to building.

1. At gates where exit devices are specified, provide heavy gauge woven wire fabric framed panels finished same as gate to prevent operation of the exit devices from the secure sides.

2. At gates where exit devices are specified, provide 3 x 3 x 3/16" steel tube center post machined for strikes set in concrete footing.

D. Stop Posts: At all gates, provide 3 x 3 x 3/16 steel tube stop posts with rubber bumpers and fitted with mechanisms for securing gates in the open position, set in concrete footings, and out of travel paths to prevent tripping.

E. Cane Bolts: Where indicated, provide painted stainless steel cane bolts with Neoprene washers in machined stainless steel receiver fabricated from 1" solid bar with stainless steel spring plug type ground sleeves set in concrete. Provide padlock hasp to secure cane bolts.

2.04 MISCELLANEOUS MATERIALS

A. Welding electrodes and filler metal.

B. Fasteners: Stainless steel.

C. Non-Shrink Non-Metallic Grout: Grout shall be Super Por-rok as manufactured by MINWAX Co., Inc. or approved equal. The grout shall be non-shrinking exterior grout. It shall consist of hydraulic cement in a ready to use formulation which, when mixed with specific amounts of water (as prescribed by the manufacturer), will provide a pourable Cementitious mixture. The product must produce a quick setting, pourable non-shrinking grout. The product must reach a compressive strength of 8000 psi in seven (7) days. Normal Por-rok as manufactured by MINWAX Co., Inc., is not an acceptable product.

D. Anchors and inserts: As provided by the manufacturer/fabricator.

2.05 FABRICATION

A. Form ornamental metalwork to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural performance.

B. Verify measurements in the field, as required for work fabricated to fit job conditions.

C. Before starting work, examine adjoining work on which work is in a way dependent or which will in any way be affected. Do such corrective work as necessary to prevent damage of adjoining work.

D. Furnish, fabricate, and finish all steel indicated on the drawings relating to this section and specified herein.

E. All joinery shall be mortise and tenon joinery. Through mortises shall be hot punched. Approximately 20 mortise and tenon joints shall also be prepared and welded at concealed locations to provide sufficient rigidity of each gate leaf. Such welds shall be full penetration welds between the shoulder of the tenon and the surface to which they are to be in contact with. All such welds shall be ground smooth and hammer textured. Where forge welding is specified, such welding shall be forged with 90% of seam welded.

F. All forging shall be coal forged.

G. Provide full penetration welds at other areas as indicated on the drawings.

H. All welds shall be ground flush. All welds at intersecting members shall be ground to a smooth inside radius corresponding to the sizes of the materials being welded.

I. Mill joints to a tight hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

J. Provide castings that are sound and free of warp or defects, which impair strength or appearance.

K. Finish exposed surfaces to smooth, sharp, well-defined lines.

L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitation. Clearly mark units for re-assembly and coordinated installation.

2.06 PAINTING

A. Preparation:

1. All loose scale to be removed by blasting in accordance with SSPC-SP6. Blasting shall be done with an air compressor having a minimum capacity of 200 psi in an environmentally controlled environment with relative humidity not exceeding 80%. The blast media shall be cast steel grit; G25, G40, or G50 in accordance with SAE J1993.

2. The painting surface shall be clean and free of oil and dirt.

B. Painting:

1. The coating system shall be applied in a suitably designed paint spray booth capable of controlling environmental conditions. Paint shall not be applied when the air, steel, or paint materials are below 50˚ F or the humidity is above 80%.

2. Primer shall be a modified epoxy, high build, high solids primer.

3. The modified epoxy primer shall be applied to achieve a dry film thickness in the range of 4.0 to 6.0 mils.

4. Primer must be fully cured prior to the application of the finish coatings.

5. Any cracks and crevices at scrolls, circles or at sandwiched components, etc., to be filled using

Tremco Dymonic polyurethane caulking after primer has cured.

6. Finish paint shall be International Interthane 990 low-VOC polyurethane paint.

7. Finish pant color shall be semi-gloss black.

8. The polyurethane finish paint shall be applied to achieve a dry film thickness to the range of 2.0 to 3.0 mils.

9. The paint shall be fully cured prior to installation.

C. The finished product shall be free of runs, sags, pinholes and holidays.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchoring and setting drawings, diagrams, templates, instructions, and directions for installation of items having directions for installation of items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the project site.

3.02 INSTALLATION

A. Perform cutting, drilling and fitting required for installation or ornamental metalwork. Set products accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels.

B. Utilize a NYS Licensed Surveyor to mark property lines and establish lines and grades for fencing in the vicinity of property lines.

C. Allow for thermal movement resulting from maximum change in ambient temperature, in the design, fabrication and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners.

D. Provide necessary lugs and brackets for assembly of units. Use concealed fasteners wherever possible.

E. Line posts shall be installed in 8” dia. x 30” deep poured concrete footings. Gate posts shall be installed in 12” dia. x 36” deep poured concrete footings for gates up to 8’-0” wide.

1. Footings shall be set 1” above finished grade and tops shall be sloped outwards for drainage.

2. Any parts to be embedded into existing footings or concrete shall be set with “Super Por-rok”.

3. When closed, gate leafs shall be approximately ¼” out of plumb (and possibly more for wide or vehicular gates, as recommended by the manufacturer/fabricator) to allow for future rotation of the concrete foundation in which gateposts are embedded.

F. Gate post footings for gates over 8’-0” wide shall be as detailed on the construction drawings.

G. Brick piers shall be as detailed on the construction drawings.

H. Provide temporary bracing as required for setting of items until adequate cure time is achieved.

I. Provide anchoring devices and fasteners where necessary for securing ornamental metal items to existing construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other such corrective work.

J. Line post caps and other finials shall be secured with stainless steel set screws.

K. Field Welding: Comply with applicable AWS specifications for procedures, for appearance and quality of welds made, and for methods used in correcting welding work. Field-welded connections, which are not to be left as exposed joints, are only permissible where items cannot be shop welded, because of shipping size or other physical limitations. Grind exposed welded joints smooth and restore to match finish of adjacent surfaces.

L. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material.

M. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required, all at the discretion of the Architect.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 323223 – SEGMENTED RETAINING WALLS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work includes furnishing and installing segmental retaining wall (SRW) units to the lines and grades designated on the project's final construction drawings or as directed by the Architect. Also included are furnishing and installing appurtenant materials required for construction of the retaining wall as shown on the construction drawings.

B. The work must comply with the requirements of the following related specifications sections when applicable:

1. Section 033000 – Cast-In-Place Concrete
2. Section 310000 – Earthwork
3. Section 310001 – Site Work General Provisions
4. Section 310002 – Stakeout
5. Section 329200 – Turf and Grasses

1.02 REFERENCE STANDARDS

A. Segmental Retaining Wall Units

1. ASTM C 1372 – Standard Specification for Segmental Retaining Wall Units
2. ASTM C 140 – Standard Test Methods of Sampling and Testing Concrete Masonry Units

B. Geosynthetic Reinforcement

1. ASTM D 4595 – Tensile Properties of Geotextiles by the Wide-Width Strip Method
2. ASTM D 5262 – Test Method for Evaluating the Unconfined Creep Behavior of Geosynthetics
3. GRI: GG1 – Single-Rib Geogrid Tensile Strength
4. GRI: GG5 – Geogrid Pullout

C. Soils

1. ASTM D 698 – Moisture Density Relationship for Soils, Standard Method
2. ASTM D 422 – Gradation of Soils
3. ASTM D 424 – Atterberg Limits of Soil

D. Drainage Pipe

1. ASTM D 3034 – Specification for Polyvinyl Chloride (PVC) Plastic Pipe
2. ASTM D 1248 – Specification for Corrugated Plastic Pipe

E. Engineering Design

1. "NCMA Design Manual for Segmental Retaining Walls," Latest Edition

F. Where specifications and reference documents conflict, the Architect shall make the final determination of applicable document. Contractor shall notify Architect of any conflicts prior to proceeding with the work.

1.03 QUALITY ASSURANCE

A. Installation shall be by a contractor and crew with at least five years of experience in placing segmented retaining walls on projects of similar nature or dollar cost.

B. Contractor shall conform to all local, state/provincial licensing and bonding requirements.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification Section 013300.

B. Product Data: Submit manufacturer's product data for each type of interlocking masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

C. Materials Submittals: The Contractor shall submit manufacturer’s certifications prior to ordering materials stating that the SRW units and geosynthetic reinforcement meet the requirements of Section 2 of this specification.

D. Design Submittal: The Contractor shall submit two sets of detailed design calculations and final retaining wall plans for approval at least two weeks prior to the beginning of wall construction. All calculations and drawings shall be prepared and sealed by a professional Civil Engineer (P.E.) – (Wall Design Engineer) experienced in SRW design and licensed in the state where the wall is to be built.

   1. Not required for unreinforced gravity walls less than 4 feet in height with level backfill, good soils and no excessive loading.

   2. Gravity walls described in Item 1 shall be constructed in accordance with standard practices and manufacturers requirements.

E. Submit physical samples of wall units to indicate color and shape selections. Color will be selected by Architect from manufacturer’s available colors.

F. Submit sieve analysis for grading of bedding and joint sand.

G. Submit test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936. Indicate layout, pattern, and relationship of paving joints to fixtures and project formed details.

H. LEED Submittals: Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 – LEED Requirements.

I. Shop Drawings: For the following in addition to 1.04D:

   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

   2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.

   3. Required Reinforcement: (if applicable) Provide details regarding required reinforcement. Show elevations & sections of reinforced walls.

   4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.05 DELIVERY, STORAGE AND HANDLING

A. Contractor shall check materials upon delivery to assure that specified type and grade of materials have been receive and proper color and texture of SRW units have been received.

B. Contractor shall prevent excessive mud, wet concrete, epoxies and like materials that may affix themselves from coming in contact with materials.

C. Contractor shall store and handle materials in accordance with manufacturer's recommendations.

D. Contractor shall protect materials from damage. Damaged materials shall not be incorporated into the retaining wall.

1.06 ENVIRONMENTAL CONDITIONS

A. Do not install work of this section during rain, sleet or snowfall.

B. Do not install work of this section over frozen base materials.

PART 2 – MATERIALS

2.01 SEGMENTAL RETAINING WALL UNITS

A. SRW units shall be machine formed, Portland cement concrete blocks, integrally colored, specifically designed for retaining wall applications. For the purposes of this specification the following product has been utilized as the standard of performance:

1. Alta Pro Wall Retaining Wall Units as manufactured by Nicolock, 612, Muncy Avenue, Lindenhurst, NY 11757, (631) 669-0700. www.nicolock.com.

2. Other manufacturers offering similar products may be provided upon proof of equivalence.

B. Color of SRW shall be selected by Architect from manufacturer standard color range.

C. Finish of SRW units shall be split-face.

D. SRW unit faces shall be of straight geometry.

E. SRW unit height shall be 8 inches and the width shall be 18 inches and have a minimum depth of 12 inches.

F. SRW units (not including aggregate fill in unit voids) shall provide a minimum weight of 105 psf wall face area.

G. SRW units shall be solid through the full depth of the unit.

H. SRW units shall be secured to one another with manufacturers specifically design locking system.

I. SRW units shall be capable of being erected with the horizontal gap between adjacent units not exceeding 1/8 inch.

J. SRW units shall be capable of providing overlap of units on each successive course so that wall meeting at corner are interlocked and continuous. SRW units that require corners to be mitered shall not be allowed.

K. SRW units shall be capable of providing a split-face, textured surface for all vertical surfaces that will be exposed after completion of wall, including any exposed sides and backs of units.

L. SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength of permanence of the structure. Cracking or excessive chipping may be grounds for rejection. Units showing cracks longer than ½ inch shall not be used within the wall. Units showing chips visible at a distance of 30 feet from the wall shall not be used within the wall.

M. Concrete used to manufacture SRW units shall have a minimum 28 days compressive strength of 3,000 psi and a maximum moisture absorption rate, by weight, of 8% as determined in accordance with ASTM C1372. Compressive strength test specimens shall conform to the saw-cut coupon provisions of ASTM C140.

N. SRW units' molded dimensions shall not differ more than + 1/8 inch from that specified, in accordance with ASTM C1372.

2.02 GEOSYNTHETIC REINFORCEMENT

A. Geosynthetic reinforcement shall consist of geogrids or geotextiles manufactured as a soil reinforcement element. The manufacturers/suppliers of the geosynthetic reinforcement shall have demonstrated construction of similar size and types of segmental retaining walls on previous projects.

B. The type, strength and placement location of the reinforcing geosynthetic shall be as determined by the Wall Design Engineer, as shown on the final, P.E.-sealed retaining wall plans.

2.03 LEVELING PAD

A. Material for leveling pad shall consist of compacted sand, gravel, or combination thereof (USCS soil types GP, GW, SP, & SW) and shall be a minimum of 6 inches in depth. Lean concrete with a strength of 200-300 psi and 3 inches thick maximum may also be used as a leveling pad material. The leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lowermost SRW unit.

B. Poured-in-Place concrete will be an acceptable leveling pad alternative.

2.04 DRAINAGE AGGREGATE

A. Drainage aggregate shall be angular, clean stone or granular fill meeting the following gradation as determined in accordance with ASTM D422.

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75-100
No. 4	0-60
No. 40	0-50
No. 200	0-5

2.05 DRAINAGE PIPE

A. The drainage collection pipe shall be a perforated or slotted PVC, or corrugated HDPE pipe. The drainage pipe may be wrapped with a geotextile to function as a filter.

B. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.06 REINFORCED (INFILL) SOIL

A. The reinforced soil material shall be free of debris. Unless otherwise noted on the final, P.E.-sealed, retaining wall plans prepared by the Wall Design Engineer, the reinforced material shall consist of the inorganic USCS soil types GP, GW, SW, SP, SM, meeting the following gradation, as determined in accordance with ASTM D422:

Sieve Size	Percent Passing
4 inch	100
No. 4	20-100
No. 40	0-60
No. 200	0-35

B. The maximum particle size of poorly-graded gravels (GP) (no fines) should not exceed 3/4 inch unless expressly approved by the Wall Design Engineer and the long-term design strength (LTDS) of the geosynthetic is reduced to account for additional installation damage from particles larger than this maximum.

C. The plasticity of the fine fraction shall be less than 20.

2.07 DESIGN PARAMETERS

A. Soil

1. If sufficient information is not otherwise included within the Contract Documents the Contractor shall provide soil borings, from a Geotechnical Engineer, as required to determine the soil conditions. The soil parameters, shall be determined by the Contractor’s Geotechnical Engineer and shall be used for the preparation of the final design. The cost of the borings and geotechnical engineering shall be included within the bid.

2. Should the actual soil conditions observed during construction differ from those assumed for the design, design shall be reviewed by the Contractor’s Wall Design Engineer at the Contractor’s Geotechnical Engineer's direction. Any additional wall requirements shall be provided by the Contractor at no additional cost.

B. Design

1. The design analysis for the final, P.E.-sealed retaining wall plans prepared by the Contractor’s Wall Design Engineer shall consider the external stability against sliding and overturning, internal stability and facial stability of the reinforced soil mass and shall be in accordance with acceptable engineering practice and these specifications. The internal and external stability analysis shall be performed in accordance with the “NCMA Design Manual for Segmental Retaining Walls,” using the recommended minimum factors of safety in this manual.

2. External stability analysis for bearing capacity, global stability, and total and differential settlement shall be the responsibility of the Owner and the Owner's Geotechnical Engineer. Geotechnical Engineer shall perform bearing capacity, settlement estimates, and global stability analysis based on the final wall design provided by the Wall Design Engineer and coordinate any required changes with Wall Design Engineer.

3. While vertical spacing between geogrid layers may vary, it shall not exceed 2.0 feet maximum in the wall design.

4. The geosynthetic placement in the wall design shall have 100% continuous coverage parallel to the wall face. Gapping between horizontally adjacent layers of geosynthetic (partial coverage) will not be allowed.

PART 3 - EXECUTION

3.01 GENERAL

A. General Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

3.02 EXCAVATION

A. Contractor shall excavate to the lines and grades required for proper installation of the wall in coordination with the finished grades indicated in the Construction Documents. General Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted structural infill material, or as directed by the Architect, at the General Contractor's expense.

B. General Contractor shall verify location of existing structures and utilities prior to excavation. General Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. Excavation support, if required, is the responsibility of the Contractor, included in his base bid costs.

3.03 FOUNDATION PREPARATION

A. Following the excavation, the foundation soil shall be examined by the Owner’s material testing agency to assure actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting the required strength shall be removed and replaced with infill soils, as directed by the Owner's Engineer.

B. Foundation soil shall be proof-rolled and compacted to 95% standard Proctor density and inspected by the Owner’s material testing agency prior to placement of leveling pad materials.

3.04 LEVELING PAD CONSTRUCTION

A. Leveling pad shall be placed as shown on the Contractors final approved, P.E.-sealed retaining wall plans with a minimum thickness of 6 inches. The leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lowermost SRW unit.

B. Granular leveling pad material shall be compacted to provide a firm, level bearing surface on which to place the first course of units. Well-graded sand can be used to smooth the top 1/4 inch to 1/2 inch of the leveling pad. Compaction will be with mechanical plate compactors to achieve 95% of maximum standard Proctor density (ASTM D 698).

3.05 SRW UNIT INSTALLATION

A. All SRW units shall be installed at the proper elevation and orientation as shown on the Contractor’s final approved, P.E.-sealed wall plans and details or as directed by the Wall Design Engineer. The SRW units shall be installed in general accordance with the manufacturer's recommendations. The specifications and drawings shall govern in any conflict between the two requirements.

B. First course of SRW units shall be placed on the leveling pad. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad. The first course is the most important to ensure accurate and acceptable results. No gaps

shall be left between the front of adjacent units. Alignment may be done by means of a string line or offset from base line to the back of the units.

C. All excess debris shall be cleaned from top of installed units and the next course of units installed on top of the units below.

D. Prior to placement of next course, the level and alignment of the units shall be checked and corrected where needed.

E. Layout of curves and corners shall be installed in accordance with the wall plan details or in general accordance with SRW manufacturer's installation guidelines. Walls meeting at corners shall be interlocked by overlapping successive courses.

F. Procedures C. through E. shall be repeated until reaching top of wall units, just below the height of the cap units. Geosynthetic reinforcement, drainage materials, and reinforced backfill shall be placed in sequence with unit installation as described in Section 3.06, 3.07 and 3.08.

3.06 GEOSYNTHETIC REINFORCEMENT PLACEMENT

A. All geosynthetic reinforcement shall be installed at the proper elevation and orientation as shown on the Contractor's final approved P.E.-sealed retaining wall plan profiles and details, or as directed by the Wall Design Engineer.

B. At the elevations shown on the final plans, (after the units, drainage material and backfill have been placed to this elevation) the geosynthetic reinforcement shall be laid horizontally on compacted infill and on top of the concrete SRW units, to within 1 inch of the front face of the unit below. Embedment of the geosynthetic in the SRW units shall be consistent with SRW manufacturer's recommendations. Correct orientation of the geosynthetic reinforcement shall be verified by the Contractor to be in accordance with the geosynthetic manufacturer's recommendations. The highest-strength direction of the geosynthetic must be perpendicular to the wall face.

C. Geosynthetic reinforcement layers shall be one continuous piece for their entire embedment length. Splicing of the geosynthetic in the design-strength direction (perpendicular to the wall face) shall not be permitted. Along the length of the wall, horizontally adjacent sections of geosynthetic reinforcement shall be butted in a manner to assure 100% coverage parallel to the wall face.

D. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum of 6 inches of backfill is required prior to operation of tracked vehicles over the geosynthetic. Turning should be kept to a minimum. Rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds (less than 5 mph).

E. The geosynthetic reinforcement shall be free of wrinkles prior to placement of soil fill. The nominal tension shall be applied to the reinforcement and secured in place with staples, stakes or by hand tensioning until reinforcement is covered by 6 inches of fill.

3.07 DRAINAGE MATERIALS

A. Drainage aggregate shall be installed to the line, grades and sections shown on the Contractor's final approved P.E.-sealed retaining wall plans. Drainage aggregate shall be placed to the minimum thickness shown on the construction plans between and behind units (a minimum of 1 cubic foot for each exposed square foot of wall face unless otherwise noted on the final wall plans).

B. For walls greater than 3 feet in height drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced-soil zone. The drainage collection pipe shall daylight into a storm sewer or along a slope, at an elevation lower than the lowest point of the pipe within the aggregate drain.

3.08 BACKFILL PLACEMENT

A. The reinforced backfill shall be placed as shown in the approved final wall plans in the maximum compacted lift thickness of 10 inches and shall be compacted to a minimum of 95% of standard Proctor density (ASTM D 698) at a moisture content within 2% of optimum. The backfill shall be placed and spread in such a manner as to eliminate wrinkles or movement of the geosynthetic reinforcement and the SRW units.

B. Only hand-operated compaction equipment shall be allowed within 3 feet of the back of the wall units. Compaction within the 3 feet behind the wall units shall be achieved by at least three passes of a lightweight mechanical tamper, plate, or roller.

C. At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing and reinforced backfill to direct water runoff away from the wall face.

D. At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

3.09 SRW CAPS

A. SRW caps shall be properly aligned and glued to underlying units with “PL Pro” adhesive, a flexible, high-strength concrete adhesive. Rigid adhesive or mortars are not acceptable.

B. Caps shall overhang the top course of units by 3/4 inch to 1 inch. Slight variation in overhang is allowed to correct alignment at the top of the wall.

3.10 CONSTRUCTION ADJACENT TO COMPLETED WALL

A. The Owners Representative is responsible for ensuring that construction by others adjacent to the wall does not disturb the wall or place temporary construction loads on the wall that exceed design loads, including loads such as water pressure, temporary grades, or equipment loading. Heavy paving or grading equipment shall be kept a minimum of 3 feet behind the back of the wall face. Equipment with wheel loads in excess of 150 psf live load shall not be operated within 10 feet of the face of the retaining wall during construction adjacent to the wall. Care should be taken by the General Contractor to ensure water runoff is directed away from the wall structure until final grading and surface drainage collection systems are completed.

3.11 GUARANTEE

A. The Contractor shall guarantee all materials and workmanship in accordance with the General Conditions and Section 017100.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 328000 – IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. When indicated on the drawings, the Contractor is to provide material and installation of a complete, automatically controlled, underground irrigation system including the following:

1. Piping, backflow preventer, sprinkler heads and nozzles, valves, controllers, control wiring, fittings, electrical connections, connections to mains, and all necessary accessories.

1.02 RELATED REQUIREMENTS

A. Construction drawings.
B. Section 310000 – Earthwork
C. Section 329301 – Plant Maintenance
D. Section 331000 – Water Systems
E. Section 333000 – Sanitary Systems

1.03 SUBMITTALS

A. Submit manufacturer's technical data and installation instructions for underground irrigation system.

B. Submit as-built layout plan and details illustrating the location and type of heads, valves, piping circuits, controls, and accessories.

PART 2 - MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. Certain manufacturers' names are used throughout these specifications to denote a standard only. All approved manufacturers' products are acceptable when products of equal or better quality and performance are submitted and approved. Product specifications must be equal to, or better, to qualify as an "or equal" product. In some product categories, there are approved manufacturers other than the ones listed in this section. Any manufacturer listed in the product category only are approved for that listed category only.

1. Rain Bird Sprinkler Manufacturing Corporation.
2. The Toro Company, Irrigation Division.
3. Weathermatic, a division of Telsco Industries.

2.02 MATERIALS

A. Pipe:

1. All main line pipe to circuit control valves shall be rigid PVC Class 200 when the static pressure is less than 100 psi and Schedule 40 when the static pressure is greater than 100 psi conforming to ASTM D 2241.

2. All circuit pipe 3/4" diameter and larger shall be rigid PVC Class 200 conforming to ASTM D

2241.

3. In areas where soil freezing occurs and local installation practices allow, flexible polyethylene (PE) pipe will be accepted as an alternate to rigid PVC pipe. PE pipe shall be SDR-11.5, PE 23, rated at 100 psi, National Sanitation Foundation (NSF) approved, conforming to ASTM D2239.

B. Pipe Fittings:

1. For PVC pipe, ASTM D 2466, socket fittings with ASTM A 2564 solvent cement.

2. For PE pipe, Type 1, PVC insert fittings designed for use with flexible pipe, ASTM D 2609. Pipe and fittings shall be jointed with stainless steel pinch claps or wormgear clamps (including stainless steel screw).

3. For copper tube fittings, provide cast brass or wrought copper, sweat solder type.

C. PVC Sleeves/Water Lines:

1. For water lines shall be rigid PVC Schedule 40 conforming to ASTM D 2241 and be sized as indicated on the drawings.

D. PVC Sleeves/Electrical Lines:

1. For pulling electrical control wire shall be rigid PVC Class 160 conforming to ASTM D 2241 and be sized as indicated on the drawings.

E. Remote Control Valves:

1. The valve shall be a Rain Bird PES Series valve, Toro 252 Series valve, or Weathermatic 11000 CR Series valve.

F. Automatic Sprinkler Controllers:

1. Provide unit capable of controlling the number of stations specified on the plans plus one blank station for future uses and complying with the following:

   a. The controller shall be housed in a UL listed, wall mountable, heavy-duty, key-lock cabinet. The cabinet shall be weatherproof for outdoor installation.
   b. The controller shall have a master valve circuit for use with a master valve to pressurize the system when the irrigation system starts.
   c. The controller shall be a Rain Bird RC-C or RC-AB Series controller; Toro C8+1, C12+1, C24+2, or H300 Series controller; or Weathermatic RM Series controller.

G. Sprinkler Heads:

1. Pop-up Spray Heads:

   a. The sprinkler shall have a matched precipitation rate brass or plastic nozzle with an adjusting screw capable of regulating the radius and flow.
   b. The sprinkler for all turf areas shall be a Rain Bird 1804-SAM-PRS; Toro 570C-4P head with 570 Series pressure compensating nozzles; or Weathermatic 35P head with 400 Series nozzles.
   c. The sprinkler for all shrub/ground cover areas shall be Rain Bird 1812-SAM-PRS; Toro 570C-12P head with pressure compensating nozzle; or Weathermatic 37P head with 400 Series nozzles.

2. Pop-up Rotor Heads:

    a. The sprinkler shall have a matched precipitation rate (MPR) color-coded nozzle with stainless steel screw capable of regulating the radius and the flow.
    b. The sprinkler shall be a Hunter Industries Professional Series G-type sprinkler; Rain Bird R-50 pop-up rotor head; or Toro Super 700 Series sprinklers.

H. Quick Coupling Equipment:

1. Valves:

    a. The quick coupling valve shall be a one-piece type, constructed of heavy cast brass.
    b. The cover shall be a durable, protective self-closing rubber cover.
    c. The quick coupler valve shall be a Rain Bird 3RC quick coupler valve or equal.

2. Keys:

    a. The valve shall be opened and closed by a single lug brass key with a detachable handle of the same manufacturer having a 3/4" inch MNPT.
    b. The quick coupler key shall be a Rain Bird #3 key or equal.

3. Swivel Hose Ell:

    a. The swivel hose ell shall be of heavy bronze construction, connected to the key for hose connections.
    b. The swivel hose ells shall be 3/4-inch FIPT x 3/4-inch Male Hose Threads.
    c. The hose swivel shall be as manufactured by the Rain Bird Sprinkler Manufacturing Company or equal.
    d. Provide a minimum of three ells for entire system.

I. Wire:

1. Provide #16 AWG UP or larger wire to electric remote control valves from the automatic controller. The wire shall be UL approved for direct underground burial.

2. Provide a single wire from the controller to each solenoid valve having insulation any color except white.

3. Provide a common neutral wire to all the solenoid valves from the controller having insulation colored white.

J. Drain Valves:

1. Provide a manual drain valve for the main line piping and a manual drain valve for the piping in each circuit.

    a. The manual drain valve shall be a 3/4 inch or larger brass or plastic ball type valve located at the lowest elevation point in the system or circuit.
    b. The valve shall be piped to a 4 cubic foot gravel drain pit or piped to daylight if adequate fall from the valve to the pipe end can be achieved.
    c. The valve shall be installed in a minimum 6 inch round valve box for easy access.
    d. In climates where the soil consistently freezes 2 inches deep or more each winter, a quick coupler valve shall also be installed just past the backflow preventer to allow for compressed air blowout of the system.

K. Backflow Preventer:

1. The backflow preventer shall be as specified in this section unless local codes allow for a double check valve assembly. The backflow preventer shall:

   a. Be a reduced pressure principle type suitable for supply pressure up to 175 psi and water temperatures up to 180°F.
   b. Have a bronze body construction. It shall utilize silicon rubber for drip tight disc material in the first and second check valves plus the relief valve.
   c. Be constructed with NPT body connections and have ball type test cocks.
   d. Have quarter run, full port, resilient seated bronze ball valve shut-offs.
   e. Consist of a pressure differential relief valve located in a zone between two positive seating check valves.
   f. Have all access ports covers secured with stainless steel screws which are bolted to the valve body.
   g. Have suitable connections for an air gap.
   h. Meet all the requirements of ASSE Standard 1013; AWWA Standard C506, FCCCHR USC Manual, Section 10.
   i. Only RPZ/DCV devices approved by the New York State Health Department will be acceptable. Plans and installation must conform to the Suffolk County Water Authority's Cross Connection Control Booklet.

L. Rainfall Sensor:

1. Provide a rainfall sensor to shut the system off during substantial rainfall. The rainfall sensor shall be Rainbird's Raincheck; Toro's Rainswitch; or Weathermatic's Rain-Stat.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Summary:

1. Stake locations of each sprinkler in accordance with the plans.

2. If discrepancies in the plan become apparent at this time, point out the discrepancy to the Owner's representative.

3. Do not proceed with the work until the necessary design engineering changes have been made and approved by the Owner's representative.

4. Install sprinkler system equipment with necessary hardware in accordance with the drawings and the manufacturer's instructions and as specified herein.

5. Verify system design pressures prior to installation.

B. Pipe Laying:

1. Do not lay pipe on unstable material or blocking, or, when in the opinion of the Owner's representative, conditions are unsuitable.

2. Trench bottom should be continuous, relatively smooth, and free of rocks and rubbish. Where ledge rock, hardpan, or rocky soil is encountered, it is advisable to pad the trench bottom with sand or compacted, fine-grained soils. Wedging or blocking of pipe is not permitted.

3. Minimum of 3" between parallel pipes in the same trench.

4. Hold pipe securely in place while joint is being made.

5. Rest full length of each pipe section firmly on bedding, excavating recesses to accommodate joints.

6. Avoid trench heating electric ducts, storm and sanitary sewer lines, existing water and gas mains, all of which have right-of-way.

7. Maintain a minimum separation of 2' from other utilities parallel to irrigation pipes.

8. Sprinkler sections shall drain to the manual drain valve placed at the low point in the section.

9. Sand or fine-grained soils should be used for cover to a sufficient depth to prevent damage to the pipe from rocks or other debris in backfill during the compacting operation.

10. Minimum cover over mains and control valves is 18" below finish grade.

11. Minimum cover over laterals is 12".

12. Do not cut sidewalk, drives, or curb during trenching for piping.

13. Use PVC sleeves under paved areas where possible; otherwise, auger bore or tunnel. Repair damaged paved surfaces during guarantee period.

14. Cover and protect open pipe ends, fixtures, and equipment from dirt, water, and chemical or mechanical damage during installation.
15. AT completion of work, thoroughly clean fixtures, exposed materials, and equipment.

C. Laying Plastic Pipe:

1. Snake in trench at least 1 foot per every 100 feet to allow for thermal expansion.

2. Socket type fittings: Solvent weld by applying PVC primer to both pipe and fitting. Apply solvent to both pipe and fitting, twisting pipe a minimum of 1/4 turn as pipe is inserted to fitting to insure a uniform coverage of the solvent.

3. Thread type fittings: Virgin liquid teflon lubricant or teflon tape all male thread components.

D. Install Sprinkler Heads:

1. Install pop-up spray heads and pop-up rotary heads flush with finish, settled grade.

2. Place part circle heads no closer than 1 inch from edge of paved areas and no further than 4 inches from edge of paved areas.

3. All sprinkler heads shall be installed with swing joints or Rainbird swing pipe and fittings or Toro funny pipe and fittings to allow for adjustment of the head and finish grade settling.

    a. A swing pipe assembly shall consist of a minimum of 12 inches of swing pipe with fitting adapters at each end threaded into the circuit pipe fitting at one end and into the head at the other end.
    b. A swing joint assembly shall consist of two street ells joined at one end of a 1/2-inch x 12 inch PVC Schedule 80 nipple and one street ell attached to the other end and threaded into the circuit pipe fitting.

E. Wiring:

1. All wire runs should be installed with no splices between the controller and the remote control valves. If splices must be utilized, they should be kept to the minimum number possible.

2. All splices at the control valves shall be installed with appropriate electrical splice connection protection.

3. All splices at locations other than the control valves shall be installed with appropriate electrical splice connection protection and installed in a 6 inch round box for ease of locating.

4. Splices shall be 3M Company, DBY Connectors, or equal.

5. Provide 12" expansion loops in wiring at each wire splice (other than the remote control valve) and at each change of wire direction.

6. Provide a 24" expansion coil for each wire at each remote control valve and where each wire enters the controller conduit. Each 24" expansion coil shall consist of 6' of wire coiled around a 1/2" piece of pipe resulting in a 24" long coil.

7. Control wiring shall be run into the controller in a separate conduit from all power supply wiring and at least 10 inches apart if both are run in the same trench.

F. Setting of Valves:

1. All valves, quick coupler, master and electric remote control shall be located in the landscaped planter areas. In no case shall a valve be located beneath a paved surface.

2. Master and electric remote control valves shall be installed in a level position only.

3. Master and electric remote control valves shall be installed in a minimum 11" x 16" or larger plastic, rectangular, marked valve box. In no case shall more than one electric remote control valve be installed in one box unless a large, 18" x 24" or larger rectangular valve box is used.

4. Quick coupler valves shall be installed in a 6" round plastic valve box with the top of the quick coupler valve as close as possible to finish grade as the valve box installation will allow.

5. A minimum 2 cubic foot gravel pit shall be installed under each master, electric remote control valve, and quick coupler valve with the top surface of the gravel pit at least 2" below the bottom of the valve.

6. A master valve shall be installed immediately after the backflow preventer to allow pressurization of the irrigation system only when the controller cycles to operation the irrigation stations. The master valve shall be the same size as the main line as indicated on the irrigation plans. The master valve shall be energized by the master valve circuit located in the controller.

G. Sleeving:

1. Furnish and install PVC sleeving where control wires or pipe pass under paved surfaces as follows:

    a. Of adequate size to allow retrieval for repair.
    b. Extend 12" beyond the end of paving at each end.
    c. Have a 4" bed of sand backfill above pipe.
    d. Have a minimum of 30" of cover from finish grade.
    e. Install permanent bench mark in curb for reference to all sleeve locations.

3.02 TEST AND FLUSHING

A. Following installation, make final adjustments of lawn irrigation system preparatory to Owner's representative's final inspection:

1. Flush system completely to remove debris, with nozzle removed.

2. Verify sprinkler operation and alignment for the direction of throw.

3. Check pop-up spray nozzling for proper arc of spray.

4. Determine whether uniform distribution exists over all areas.

B. Following final adjustment, operate the entire installation to demonstrate the complete and successful operation of all equipment.

3.03 WARRANTY

A. The irrigation system shall be warranted for a period of one year from the time of acceptance, for parts and labor by the installing contractor. This warranty shall be bonded and written to the Owner for both the warranty and the maintenance as outlined in the maintenance section.
B. The irrigation system equipment shall be warranted by the manufacturer for a period of three years from the date of installation, provided the system has been installed with all its equipment manufactured by one manufacturer. The only exception to this requirement are the electric remote control valves which shall be warranted for a period of 5 years by the manufacturer.

3.04 OPERATION AND MAINTENANCE

A. Maintenance:

1. Provide one hour operating instructions for Owner's representative prior to final acceptance.

2. Provide on-job site consultation with Owner's operating personnel for 6 months, not to exceed 4 hours per month, at no charge to the Owner. Any consultation work beyond this time limit shall be billed to the Owner on a time and materials basis. This extra consultation must be approved by the Owner's representative before said consultation shall be gin.

3. A three-year maintenance program with the property owner shall be included with the installation contract. This shall include all labor and materials to perform the following:

   a. Spring start-up of the system as soon as weather permits in the spring. Spring start-up shall include, but is not limited to, setting of the controller for proper operation, turning on water supply (if it has been turned off), and all the components that were winterized (backflow valve, etc.), close all the manual drain valves, check all valves and heads for proper operation and adjustment.
   b. Monthly checks of the system for proper operation and adjustment through the growing season.
   c. Winterize the system in the fall, after the irrigation season is over and before the first major freeze. Winterizing includes, but is not limited to, draining system and/or compressed air blow-out of the system (air pressure not to exceed the working pressure of the system), setting the controller for winter operation, checking exposed components (backflow preventer, etc.) for potential freeze damage, and draining all the manual drain valves. Winterizing may also include items not included in these specs but are usually included in winterizing programs in the local area.

B. Record Drawings and Controller Chart:

1. Maintain a complete set of up-to-date as-built drawings.

2. Prepare a controller chart:

    a. Showing the location of all sections, valves, lateral lines, and routes of control wires.
    b. Identify all valves as to size, station number, and type of irrigation head on each valve.
    c. Showing each station's area of coverage using a color coding, each station having a different color shading its area of coverage.
    d. Laminated between two pieces of plastic laminate.
    e. Complete and receiving approval prior to final inspection of the irrigation system.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 329200 – TURF AND GRASSES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section is subject to all applicable provisions of the "General Conditions" and "Supplementary General Conditions", which form a part hereof whether attached hereto or not.

B. Under this item, the Contractor shall furnish and install topsoil, lawns and grasses in accordance with the plans, specifications, and as ordered by the Architect. This Contract includes all work of this Trade for a complete coordinated job, in order to provide an acceptable stand of turf by creating a rootzone mixture with seed or sod, including **decompaction of existing 12" of existing play field surfaces**, grading, topdressing, placing topsoil, soil amendments and sod, in accordance with the drawings as specified. The Contractor recognizes that the Plans and Specifications which form a part of this Contract reflect the overall intention and functional purpose, but that in all aspects the detailed Plans and Specifications might not be complete, but the Contractor does include as part of this work any and all provisions whether or not shown, to make his work under this Contract complete in every respect and to make any and all systems that he is responsible for complete system and to be in accordance with all authorities having jurisdiction.

C. Furnish all labor, material and appurtenance required for the installation of Topsoil and Seed as shown on the drawings and/or as herein specified. In general the work shall include but not necessarily be limited to the following:

1. Decompaction of existing 12" of existing play field surfaces, and placing (fine-grading) of topsoil as required for seeding.

2. Seeding, sodding and establishing permanent grass lawns or swale areas.

3. All other work required to complete the work of seeding, sodding and related items as shown on the drawings and as herein specified.

4. Establishment, protection, maintenance, clean-up and replacement of lawns as required under the specified guarantee.

D. The work must comply with the requirements of the following related specifications sections:

1. Section 013563 "LEED Requirements" for additional LEED requirements (For LEED Certified Projects)
2. Section 017419 "Construction Waste Management" for recycling construction waste (For LEED Certified Projects)

E. Section 310000 – Earthwork

F. Section 312500 – Erosion and Sediment Controls

1.02 SHOP DRAWINGS, SUBMISSIONS AND APPROVALS

A. All submissions shall be in accordance with Section 013300 submission requirements.

B. Submit manufacturer's product data for each material or accessory to be utilized in association with the work of this section. Include MSDS sheets for all fertilizers and limestone.

C. Submit topsoil certifications and test reports.

D. Within seven (7) calendar days after awarding of the Contract, submit the following:

E. List of all materials, equipment, and manufacturers proposed to be furnished. Shop drawings will not be reviewed prior to approval of the list of manufacturers.

F. List of name of any subcontractors to be used for approval.

G. Interim and final as-built surveys; reference Quality Assurance section below and Specification Section 017839.

H. **LEED Submittals: For LEED Certified Projects: Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 "LEED Requirements".**

1.03 REQUIREMENTS / QUALITY ASSURANCE

A. The Contractor shall provide his own Engineer and/or Licensed Surveyor for establishing all topsoil and seed limits in the field and grades as required to meet the requirements of the Contract Documents.

1. For athletic fields: Upon completion of subgrade, prior to laying topsoil, the contractor shall provide an interim topographical survey in the datum of the Construction Documents for review for conformance by the Architect. Spot elevations on said survey shall be in complimentary locations to the Construction Drawings.

B. Notice of Sources: Within 10 days following award of Contract, the Contractor shall notify the Architect of the sources of the materials required; they may be inspected and tested if desired by the Architect.

C. Topsoil Testing: The Contractor shall take samples of the topsoil and have tests made to determine the appropriate proportions of supplements necessary for properly conditioned material (such as "Quick Test" to determine if lime should be used). Methods used shall be as approved by the Association of Agricultural Chemists or the State Agricultural Experiment Station. Preparation work necessary to bring the topsoil into proper condition to receive seeding shall be made in accordance with said tests at no additional cost to the Owner. Copies of said tests and recommendations are to be submitted to the Architect for approval prior to starting the Work of this Section.

D. Fertilizer Application: The following shall apply to all of the work included in this specification section;

"Under New York State Law", phosphorus-containing fertilizer may only be applied to lawn or non-agricultural turf when:

- A soil test indicates that additional phosphorus is needed for growth of that lawn or non-agricultural turf; or

- The fertilizer is used for newly established lawn or non-agricultural turf during the first growing season."

Application Restrictions (all fertilizers)

New York State – no application between December 1 and April 1.
Nassau County – no application between November 15 and April 1.
Suffolk County – no application between November 1 and April 1.

E. Seeds: Packages of seed shall bear official State or Federal stamps and certificates indicating the type, quality, and content of the seed packages. Deliver packages unopened.

1.04 VERIFYING CONDITIONS

A. The Contractor shall examine all drawings which may affect the work of this section or require coordination by same.

B. Before starting any work, examine existing conditions and thoroughly check all drawings, specifications, adjoining or underlying conditions in which the work of this section is to be performed, and all dimensions.

C. Report in writing to the Architect any and all conditions which may interfere with or otherwise affect work of this section.

D. Seeding operations shall be conducted under favorable conditions during the next season or seasons which are normal for such work as determined by accepted practice in the locality of the Project.

1.05 PROTECTION OF WORK

A. Landscaped areas shall be protected by the Contractor against traffic damage, erosion, or other use by erecting barricades or temporary fencing immediately after seeding is completed and by placing warning signs of a type approved by the Architect on various areas. These barricades, or temporary fencing, and signs shall be maintained until the lawns are well established.

B. The Contractor shall maintain all seeded areas without additional payment until the expiration of the maintenance period. Any areas that fail to show a uniform stand of grass will be reseeded and re-fertilized at the Contractor's expense, until an acceptable stand of grass is established.

C. Upon final acceptance of the work specified herein, the Contractor shall remove all barricades or temporary fences.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil: Stockpiled topsoil may be used, provided it meets the requirements of these specifications. Additional topsoil from certified off-site sources shall be used, provided it meets the requirements of these specifications. Topsoil for lawn and planting operations shall be fertile, friable, natural loam containing a liberal amount of humus. It shall be free of admixtures and subsoil and shall be reasonably free of noxious weed, seed, lumps, plants, or their roots, and completely free of stones, sticks, and other extraneous matter, and shall not be used for planting operations while in a frozen or muddy condition. After spreading to a uniform depth of 6" minimum, all topsoil shall be raked to remove all extraneous matter. Raked topsoil shall conform to the mechanical analysis specified below and shall be free of stones, lumps, plants or their roots, sticks and similar debris, or any other undesirable material. Topsoil shall not be used in a muddy or frozen condition.

1. All topsoil to be furnished shall be subject to the approval of the Architect. Furnish a certified analysis, made by a recognized authority, of any topsoil that may have to be furnished to complete the work of this section. Test reports shall match the format listed below.

2. Topsoil shall have an acidity range of pH 5.0 to 7.0 and shall contain not less than 6 percent organic matter as determined by loss on ignition of moisture-free samples dried at 100 degrees centigrade. The mechanical analysis of the soil shall be as follows:

Passing	Retained On	Percentage
1" screen		100%
1" screen	¼" screen (gravel)	Not more than 3%
¼" screen	No. 100 USS mesh sieve (sand)	40%-60%
#100 USS	(Very fine sand, silt & clay)	40%-60%

3. Topsoil in which more than 60 percent of the material passing the USS No. 100 mesh sieve consists of clay as determined by the Pouyoucous hydrometer or by the decantation method, shall not be used. All percentages are to be based on dry weight samples. The chemical and mechanical analysis shall state the above items in correct quantities.

4. The Architect reserves the right to take samples of the topsoil from time to time, whether delivered to or stored at the site. These samples will be analyzed for comparison with the Specifications. Should tests show that topsoil does not comply with the Specifications, the material may be rejected or such other remedy made as approved by the Architect in the form of the addition of humus or other supplemental materials.

5. The topsoil mixture materials shall be thoroughly mixed by hand or by rotary mixer to the satisfaction of the Architect.

B. Sand: Sand shall be ASTM C-33 concrete sand. The sand shall have a fineness modulus of 2.5-3.2 and a coefficient of uniformity of less than 4.

C. Ground Limestone: Ground Limestone (calcium carbonate) shall have the following analysis: at least fifty (50) percent shall pass a 200 mesh sieve; at least ninety (90) percent shall pass a 100 mesh sieve; and one hundred (100) percent shall pass a 10 mesh sieve. Total carbonate shall not be less than eighty-five (85) percent for purposes of calculation, total carbonate shall be considered as calcium carbonate.

D. Organic Fertilizer: Organic fertilizer shall be used for surface application after grass has germinated. Organic activated fertilizer shall contain the following percentage by weight: 5% minimum of nitrogen, 45% phosphoric acid, and other nutritious basic elements.

E. Chemical Fertilizer: Commercial fertilizer shall be used for initial preparation and shall conform to the applicable state fertilizer laws. Commercial fertilizer shall be a complete fertilizer and shall be an organic based product suitable for the establishment of the turf and grass species described herein and/or as noted on the Contract Plans. Examples of acceptable products and Suppliers/Manufacturers are: *PRO-GRO* by *North Country Organics* of Bradford VT., Ph. (802) 222-9661; *LAWN BOOSTER* by *Organica Inc*. of Norristown PA., Ph. 1-888-24GREEN, or locally at (631) 544-0348.

1. Application rate, sequence, and methods shall be as recommended by the manufacturer based on soil conditions of the areas of installation as tested by the Contractor, and on the intended grass stand character (i.e. turf area). The Contractor shall coordinate the review of the recommendations between the Architect, the Manufacturer, and the Contractor's Installer. Commercial fertilizer application shall be properly coordinated with the application of any other soil amendments that may be necessary.

F. Humus / Compost: Humus shall be of native type and consist of reed peat or sedge peat, but not peat moss, and of such physical condition that it can be readily incorporated with topsoil. It shall be free from sticks, stones, weedy roots, glass or toxic substances or other foreign matter. When delivered from stock piles, humus shall contain between 35 percent and 50 percent moisture. Use only natural domestic humus suitable for soil mulch and of such composition as to furnish ample water holding capacity and retention of plant food. Humus shall be dark brown to black in color, granulated, free of weed seed and lumps and show analysis as follows:

1. 25 percent - 45 percent moisture by weight as delivered from stockpile.
2. 5.0 - 7.5 pH (acidity).
3. Minimum 300 percent water absorbing ability (oven dried at 100 C.).
4. 85 percent minimum organic matter on dry basis (samples dried at 65 C.).
5. Low in content of wood material, suphur, iron, or other heavy metals.
6. Ash, on dry basis: not more than 10 percent.
7. Soluable salts less than 4.0.
8. Solvita Maturity number between 6 and 8.
9. Carbon / Nitrogen ratio - greater than 30:1.
10. Particle size shall pass a ¼" screen.
11. Low phosphorous and nitrogen content.

Humus shall be obtained from fresh water site, conditioned in storage piles after excavation for at least 6 months, including one freezing, thawing period.

Certification and Testing: The Contractor shall submit a certificate of materials regarding the composition of the compost from a certified Seal of Testing Assurance Program, Compost Testing Program Laboratory. The test shall be for the actual material to be used on the project, from the stock piles. Stock piles of this material shall be visited by the Landscape Architect, with all expenses paid for by the Contractor.

One such laboratory is located on Long Island:

SOIL FOODWEB NEW YORK, INC.
555-7 Hallock Avenue
Port Jefferson Station, NY 11776
Phone: (631) 474-8848
Fax: (631) 474-8847
info@soilfoodwebnewyork.com

G. Mulch: Weyerhauser "Silva-Fiber", or equal, available from American Excelsior Corporation, Chicago, Illinois.

H. Erosion Control Blanket: Use "Ero-Mat, standard", as manufactured by Verdyol and distributed by Erosion Control Systems, Inc., Tuscaloosa, Alabama; (1-800-942-1986). Install with 11 gauge or heavier steel wire staples with 6 inch long legs and a 1 inch crown. Note: "Ero-Mat, High Velocity" for use on slopes greater than 3:1 and 60 ft. long; or in areas where a high velocity of water is expected - duration is 4-1/2 to 5 feet/second range (in swales).

I. Water for Turf Establishment: Water suitable for turf establishment will be available on-site to the Contractor as coordinated with the Owner. The Contractor shall provide all devices required for the distribution of water (provided by Owner) until turf is fully established. If an irrigation system has been installed or is already in place, this shall serve for distribution. The proper amount and frequency of watering will be the responsibility of the Contractor. In general terms, during dry weather, grassed areas shall be watered daily with sprinklers until grass is firmly rooted.

J. Grass Seed: The Contractor shall furnish and place all materials required for seeding in all topsoiled areas. The seed used shall be fresh, re-cleaned seed of the latest crop, mixed in the following proportions by weight, and meeting the following standards of pure live seed content. The tolerance for PLS (purity x germination) shall be those called official and tabulated on page 5, US Department of Agriculture Bulletin No. 480.

Grass seed mixes shall be as noted below. Submit mix percentages for approval. Percent pure live seed (PLS) shall be 95% minimum. Maximum percent weed seed shall be .50%. Germination shall be 85% or better.

All seed shall be delivered in the original packages, unopened, which shall include a guaranteed analysis by the vendor. The seeds shall be pre-mixed prior to delivery to the job site, or as otherwise directed by the Architect. The grass seed shall be of the latest crop, mixed in the following proportions by weight:

70% - Tall Fescue
20% - Turftype Ryegrass
10% - Kentucky Bluegrass

All seed shall exhibit minimum 98% Purity and minimum germination of 90%.

Unless specifically indicated otherwise above, the following varieties of turfgrasses shall include:

Tall Fescue: *Rebel, Falcon, Mustang, Jaguar, Houndog.*
Turftype Ryegrass: *Manhattan II, Prelude, Palmer, Omega, Regal*.
Kentucky Bluegrass: *Eclipse, Adelphi, Glade, Sydsport, Baron*.

The rate of seeding shall be as recommended by the supplier/manufacturer for the type of seeds used in the mix and the intended purpose of the planted area. The intent of the Restored Lawn Area seeding is to provide turf lawn to blend in with the areas adjacent to the disturbed area being planted. Supplier shall coordinate the final rate with the Architect, who shall have final authority for approval. Grass seed shall be sown in the fall from August 25 to October 1, or in the spring, between March 15 and May 1. Seeding shall be done in dry or moderately dry soil, and at times when the wind velocity does not exceed 5 mph.

Sowing of Seed: Immediately before any seed is to be sown, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable and of uniformly-fine texture. Lawn areas shall be seeded evenly with a mechanical spreader, at a rate of 10.0 pounds to 1,000 sq.ft. of ara, lightly raked, rolled with a 200 pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor to establish a smooth, uniform turf composed of the grasses specified. Re-seeding shall be done in accordance with this procedure.

Grass seed shall be sown in three different passes by approved machine in such a manner that a uniform stand will result. After seeding, the surface shall be evenly raked with a fine toothed rake and rolled with an approved roller, as directed by the Architect. Seeding by hydraulic means may be used if approval is obtained from the Architect.

K. Sod: Sod shall be provided where specified within the contract drawings and may be used as an alternative to seed to establish turf in the areas called out for seeding (at no additional cost to the Owner). The Contractor shall request the alternative if it is needed to complete the project in weather not conducive to turf establishment by seeding, or as specified on the drawings. The Architect shall approve the use of the alternative. All sod shall be grown and cut from a sand-based field. Approved sod is superior sod grown from high-quality seed of known origin. Seed is to be inspected by Certification Agency to assure satisfactory genetic identity and purity, overall high quality and free from noxious weeds at time of harvest.

1. The sod shall be of the highest quality, strongly rooted, free from noxious weeds and grubs, mowed to a height not to exceed 3” prior to lifting, cut in minimum 18" wide x 5' lengths (7-1/2 sq.ft.) to a depth of 1" minimum, or in rolls 4’ wide x 50’ long (200 sq.ft.) and shall be at least one year old. Measurement for thickness shall exclude top growth thatch. It shall be harvested from one field to ensure a uniform color and texture. Sod shall be machine cut. Standard sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically. Sod shall not be harvested or transplanted when moisture content may adversely affect its survival.

2. The mixture of grass seed from which the sod was grown shall consist of approximately the following mixture of permanent grasses: 70% Tall Fescue, 20% Turftype Ryegrass, 10% Kentucky Bluegrass - or - 50% shade tolerant Kentucky Blue Grass - 20% Manhattan II Rye Grass - 30% Pennlawn Fine Fescue (blend as selected by the Architect). All sod shall be inspected prior to delivery.

3. Sod shall be harvested, delivered and transplanted within a period of 36 hours. Before cutting, sod shall be mowed uniformly at a height of 1-1/2 inches.

4. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section.

5. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

6. Thatch: Sod shall be relatively free of thatch up top ¼ inch allowable (uncompressed).

7. Diseases, Nematodes and Insects: Sod shall be reasonably free of diseases, nematodes and soil-borne insects.

8. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than two (2) such plants are found per 200 s.f. of area. Sod will not be acceptable if it contains any of the following weeds: common Bermuda grass (wire-grass), quackgrass, johnsongrass, poison ivy, nutsedge, niblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel and bromegrass.

9. Architect/Engineer may inspect the sod before it is harvested, but reserves the right to reject, on or after delivery, any sod which in his opinion does not meet with the specification requirements.

L. Rootzone Mix Ratio: The rootzone mix shall utilize all existing topsoil stockpiled and shall incorporate an additional 3” of sand and 1” of compost at no additional cost to contract.

M. Topdressing: The entire portion of the field not being repaired for low spot filling shall receive a full ½” of topdressing using organic matter which shall be a mature, stable compost with an organic matter content of 6-8% and be free of glass or toxic substances. This material is available from *Agresource*, called *Agresoil Compost*, and is made from bio solids, not leaf mold. Contact number: 1-800-313-3320.

N. Overseeding: Overseeding shall be accomplished by a drill seeder in three different passes using the following seed mixture:

Percent	Turfgrass Species / Variety	Min. Purity %	Germ. %
70%	Tall Fescue	98%	90%
20%	Turftype Ryegrass	98%	90%
10%	Kentucky Bluegrass	98%	90%

Acceptable varieties of each turfgrass shall include:

Tall Fescue: *Rebel, Falcon, Mustang, Jaguar, Houndog*.
Turftype Ryegrass: *Manhattan II, Prelude, Palmer, Omega and Regal*.
Kentucky Bluegrass: *Eclipse, Adelphi, Glade, Sydsport and Baron.*

Rate of seeding shall be 10 lbs. per 1,000 sq.ft. pf pure live seed (pls.).

PART 3 – EXECUTION

3.01 STRIPPING TOPSOIL

A. All topsoil shall be stripped as described and stockpiled for reuse. No topsoil is to be removed from the site.

3.02 GRADING AND SUBGRADE PREPARATION

A. Perform grading operations to bring subgrade to levels required and to contour indicated on the drawings.

B. Completed subgrade shall be approved by the Architect/Engineer before topsoil and sodding.

C. The approved subgrade shall be scarified to a depth of 2 inches to permit mixing with rootzone material.

D. Where work involved is not in an area designated for regarding, the existing grade shall be rototilled to a depth of 8 inches. The area shall then be leveled and stones raked out.

3.03 ROOTZONE / SEED BED PREPARATION

A. Seasonal and Weather Limitations – All operations including seedbed preparation shall be performed only when the soil is in proper condition to permit satisfactory work. Continuation of work at other than specified times or conditions shall proceed only with consent of the Architect/Engineer.

B. Leveling – Any undulations or irregularities in the surface resulting from tillage or any other causes shall be leveled prior to placing sod. Flooded, washed out or otherwise damaged areas shall be reconstructed and all grades reestablished in conformance with the drawings and specifications.

C. Before any soil is placed, the subgrade shall be graded to a smooth, uniform surface, parallel to and below finished grade. The subgrade surface shall be compacted with an approved roller weighing approximately five hundred (500) pounds, then scarified to a depth of 3” for proper mix of rootzone material. Hollows, depressions and gullies shall be filled with acceptable material free from stones over two inches (2”) in diameter, cinders, rubbish and other unsuitable material.

D. **New rootzone shall be decompacted to a depth of 12”** prior to seeding or sodding utilizing a ‘BLEC’ Ground Breaker Machine, VertiDrain or equal; on 10” centers, using 5/8” wide slits, **12” deep** to provide compaction relief. Rototilling the fields is specifically excluded.

E. Cleanup – Prior to placing sod, the surface shall be cleared of all trash, debris and stones larger than two inch (2”) diameter, and of all roots, brush, wire, grade stakes and other objects that could be a hindrance to maintenance operations and use.

F. Commercial Fertilizer:

1. Fertilizer for Rootzone Mix: Commercial fertilizer (14-28-15) shall have the following composition by weight: Nitrogen 14%; Phosphorous 28%; Potash 14%; as manufactured by Jonathan Green “New Seeding Lawn Fertilizer”.

2. Fertilizer for Post Seeding/Sodding: 50% slow release commercial fertilizer (28-3-5) shall have the following composition by weight: Nitrogen 28%; Phosphorous 3%; Potash 5%. The guaranteed analysis shall have a minimum 50% of the total nitrogen as a “slow-release” type.

    a. Contractor shall at the direction and discretion of the Architect/Engineer furnished a certified report of an approved analytical chemist, showing the analysis of representative

samples of the commercial fertilizer which he proposes to use. All samples are to be taken by the Architect/Engineer, and delivered to the laboratory; the price bid shall include inspection and laboratory charges. No commercial fertilizer shall be delivered until the approval of samples by the Architect/Engineer, but such approval does not constitute final acceptance. The Architect/Engineer reserves the right to reject on or after delivery any material which does not, in his opinion, meet these specifications.

b. Apply new seeding lawn fertilizer at the full rate recommended by the manufacturer for new lawns, using a mechanical spreader, not by hand; Fertilizer shall then be worked lightly into the top 3" of the rootzone material.

c. Apply 50% slow-release type fertilizer as soon as sod has been installed. The first application shall be made at ½ the manufacturer's recommended rate for new lawns. A second application shall be made at ½ the manufacturer's rate for new lawns six (6) weeks after the first application of same.

G. Topsoil Placement and Finish Grading:

1. Topsoil shall be spread on the previously prepared subgrade or surface of select granular fill, scarified to permit proper bonding with the topsoil. The topsoil shall be placed on all specified areas within the Limit Lines shown on the drawings, all areas disturbed by the work of this contract, and as directed by the Architect.

2. Topsoil shall be raked, properly set and compacted to establish uniform lawn/grass growth, and otherwise manipulated to form, after settlement, smooth draining grades as shown on the drawings. The depth of the topsoil for lawn areas after compaction shall be six inches.

3. The Contractor shall provide, at his own expense, protection for all topsoil areas against trespassing and damage at all times. Damaged areas shall be treated or replaced as directed by Owner's Representative.

H. Install irrigation system components for initial turf establishment only in accordance with the system manufacturer's instructions, as noted on the Contract Drawings, and as required by local jurisdictional regulations, to provide a fully operational system. In all cases, minimize the disturbance of previously placed materials and repair any damaged sections.

I. If a temporary irrigation system is indicated within the Contract Drawings, it's installation shall be properly coordinated by the Contractor so as not to affect the seeding process. Temporary systems shall remain until required stand of grass and percentage germination has been established and maintained for a minimum of two (2) weeks from initial germination.

3.04 SEEDING OPERATIONS:

A. General:

1. Furnish all materials required for seeding lawn areas in topsoiled areas.

2. Prior to seeding operations, all areas to be seeded shall be thoroughly disked or otherwise loosened to a depth of 4 inches and shall be carefully raked to true lines free from all unsightly variations, bumps, ridges or depressions, brought to finished grade elevations as shown on the drawings. All sticks, stones, roots or other objectionable material which might interfere with the formation of a finely pulverized seed bed shall be removed from the soil. Two pounds of 15-20-10 formula commercial fertilizer per cu.yd. shall be thoroughly mixed with the topsoil or not less than 10 lbs. per 1,000 sq.ft. of lawn surface, whichever is the greater.

3. Seeding:

a. Purpose: To provide permanent vegetative cover and to control storm water run-off and erosion.

b. Where Applicable: All areas not covered by buildings and pavement within the limit lines as shown on the contract plans, and all other existing lawn areas disturbed or damaged by the work of this contract.

4. All areas to be seeded in lawn shall be thoroughly disked or otherwise loosened to a depth of four (4) inches and shall be raked to true lines, free from all unsightly variations, bumps, ridges or depressions. As specified, all sticks, stones, roots or other objectionable material that might interfere with the formation of a finely pulverized seed bed shall be removed from the soil. Ground limestone, humus and commercial fertilizer shall be applied as specified:

5. Apply ground limestone uniformly at a minimum rate of 100 pounds per 2,000 square feet, or as determined by analysis. The ground limestone shall be distributed evenly, by machine, over all areas to be seeded. It shall be worked lightly into the top three (3) inches of the soil, at least five (5) days before applying fertilizer.

6. Apply fertilizer uniformly at a minimum rate of 10 pounds per 1,000 square feet. Fertilizer to be 10-10-10. Apply humus at the rate of 3-1/3 cubic yards per 1,000 square feet. Note: Application rate, sequence, and methods shall be as recommended by the manufacturer based on soil conditions of the areas of installation as tested by the Contractor, and on the intended grass stand character (i.e. turf area). The Contractor shall coordinate the review of the recommendations between the Architect, the Manufacturer, and the Contractor’s Installer. Commercial fertilizer application shall be properly coordinated with the application of any other soil amendments that may be necessary.

7. Work lime, fertilizer and humus into soil to a minimum depth of 3 inches using any suitable equipment.

8. The soil shall then be raked to a smooth, even draining surface and properly set and compacted to establish uniform lawn/grass growth with an approved roller or as otherwise directed by the Architect. Manipulate to form, after settlement, smooth draining grades as shown on the drawings. Any depressions which occur shall be re-graded and re-rolled until a satisfactory grade is obtained.

9. Time of Seeding: Grass seed shall be sown preferably in the fall between August 15th and October 1st or in the spring between April 1st and May 15th, or at such other times as are approved by Owner's Representative. All seeding is to be done in dry, or moderately dry soil and at times when the wind does not exceed a velocity of five miles per hour.

10. Seed shall be sown at the rate as recommended by the supplier/manufacturer for the type of seeds used in the mix and the intended purpose of the planted area. The intent of the Restored Lawn Area seeding is to provide turf lawn to blend in with the areas adjacent to the disturbed area being planted. Supplier shall coordinate the final rate with the Architect, who shall have final authority for approval. Grass seed shall be sown in the fall from August to October, or in the spring, between March and May. Seeding shall be done in dry or moderately dry soil, and at times when the wind velocity does not exceed 5 mph. Grass seed shall be sown by approved machine in such a manner that a uniform stand will result. After seeding, the surface shall be evenly raked with a fine toothed rake and rolled with an approved roller, as directed by the Architect. Seeding by hydraulic means may be used if approval is obtained from the Architect.

B. Hydroseeding Option: The Contractor may utilize a hydroseeding option, as indicated above. If hydroseeding shall be supplied as a zero-cost option to the Owner, the Contractor shall supply the name, address and contact information of his hydroseeding subcontractor to the Architect for contact and discussion. The hydroseed blend to be submitted by the Contractor shall be equal and

comparable to the standard seed blend(s) indicated within this specification section for the intended turf establishment. The blend shall be submitted to the Architect in advance as a part of the shop drawings submittal process.

3.05 MULCHING:

A. All seeded areas shall be covered with approved mulch not later than 3 days following seeding. Ground surfaces shall be completely covered at the rate of at least 2 tons an acre. The Contractor shall utilize a Bowie Hydromulcher or equal to apply all mulch.

B. All areas to receive permanent seeding shall be mulched as described in the specifications and as noted herein.

C. On slopes 4 horizontal to 1 vertical, or greater, and in drainage swales, mulch shall be anchored using erosion control blanket or other approved netting properly fastened in place. Install rolls in proper direction with overlap and staple pattern set in accordance with the manufacturer's requirements.

D. In any event, the Contractor is responsible for mulch remaining intact until grass has germinated and has reached a minimum height of one inch.

3.06 SODDING:

A. The Contractor shall furnish and place all materials required for sod in all topsoiled areas. The sod may be installed at any time between August 15th and June 1st when the ground is not frozen. Sod shall be placed only when weather and soil conditions are suitable for proper knitting and development of sod. Sod shall not be placed on a muddy rootzone or during periods of extreme heat. No sod shall be installed without approval of the Architect. All areas to receive sod shall be thoroughly disked or otherwise loosened to a depth of 4 inches and shall be raked to true lines free from all unsightly variations, bumps, ridges, or depressions. All sticks, stones, roots or other objectionable material which might interfere with the formation of a finely pulverized seed bed shall be removed from the soil.

B. The sod shall be placed on a minimum of 4" of properly compacted topsoil. The sub grade of topsoil shall be graded so that after the sod is placed, the finished grade shall meet existing grades specified by the Architect. The soil shall be raked to a smooth, even-draining surface, and compacted with an approved roller as directed by the Architect/Engineer. Any depressions which occur shall be re-graded and re-rolled until a satisfactory grade is obtained.

C. Before the sod is placed, an application of super-phosphate shall be applied to the sub-grade topsoil at the rate of 20 pounds per 1,000 square feet and raked into a depth of 1 inch.

D. Starter Strip; The first row of sod should, if possible, be laid in a straight line with subsequent rows placed parallel and tightly against one another. Lateral joints shall be staggered to promote a more uniform growth and strength. Care shall be exercised to ensure that the sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would permit air drying of the roots. The sod shall be placed in 18" x 5' lengths and rolled with at least a 200-pound roller; as the sod is completed in any one section, the entire area shall be rolled. After rolling, the finished grade shall conform evenly to the grades on the plan or according to given grades by the Architect. The sod shall then be thoroughly watered to a depth sufficient that the underside of the new sod pad and soil immediately below are thoroughly wet.

E. Watering During Installation: During periods of high temperature, the sod shall be lightly watered to prevent wilting during the progress of the work; as sod is completed in any one section, the entire section shall be thoroughly irrigated to a depth of 5 inches or more. In general, the sod shall be thoroughly watered until the root system has become sufficiently knit, at which time the Contractor

will be relieved of his responsibility for maintenance and watering. Watering apparatus shall then be removed by the Contractor.

F. Joint Dressing: As soon as practical following the initial watering, but in every case prior to the second watering, the entire area shall be examined for open joints or other signs of surface imperfections. Any open joint or other voids shall be carefully filled with sand to prevent air drying of the roots and to eliminate undulations in the surface.

G. The first mowing shall not be attempted until the sod is firmly rooted and secure in place. Not more than 40% of the grass leaf shall be removed by mowing. Grass height shall be maintained between 1-1/2" and 2-1/2" until final acceptance and completion of the whole work under this contract. Any unsatisfactory sod shall be removed and replaced at the Contractor's expense.

3.07 RECONDITIONED LAWNS

A. Recondition existing lawn areas damaged by the Contractor’s operations, including storage of materials or equipment and movement of vehicles. Also, recondition lawn areas where settlement or washouts occur or where minor regrading is required.

1. Recondition other existing lawn areas.

B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from the Contractor’s operations, including oil drippings, fuel spills, stone, gravel and other construction materials, and replace with new topsoil.

C. Where substantial lawn remains, mow de-thatch, core aerate and rake. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. DO not use pre-emergent herbicides.

D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation and turf, and legally dispose of it off the Owner’s property.

E. Till stripped, bare and compacted areas thoroughly to a depth of 6 inches.

F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Provide new planting soil as required to fill low spots and meet new finish grades.

G. Apply seed and protect with straw mulch as required for new lawns.

H. Water newly-planted areas and keep uniformly moist until new grass is established.

3.08 WATERING

A. The Contractor shall be responsible for the proper watering for all sodded areas until Substantial Completion of the work as hereinafter specified. The proper amount and frequency of watering will be the sole responsibility of the Contractor.

B. In the absence of adequate rainfall, watering shall be performed daily during the first week, and shall be sufficient to maintain moist soils to a depth of at least 5 inches. Water should be applied immediately if at any time the sod shows indications of wilting.

C. Subsequent Watering: Sod shall be watered as required to maintain adequate moisture in the upper 5 inches of soil. In the absence of rainfall, sod shall be watered at frequencies dictated by need.

3.09 CLEAN-UP

A. Soil, manure, peat or similar material which has been brought onto paved areas by hauling operations or otherwise shall be removed promptly, keeping these areas clean. Upon completion of the planting, excess stones and debris, which has not been previously cleaned up, shall be removed from the site or disposed of as required by the Architect, except topsoil shall be spread or piled on the site as directed by the Architect. Lawns and planting areas shall be prepared for final approval.

3.10 MAINTENANCE, REPLACEMENT, GUARANTEE AND FINAL INSPECTION:

A. Maintenance operations shall begin immediately after the seed is sown/sod installed and shall be continued as required until Substantial Completion. Grass shall be kept in healthy growing condition by mowing, watering, weeding, cultivating, disposal of waste vegetation, fertilizing, spraying or spreading of approved materials to prevent or treat infestations of insects or disease and all other operations required to produce and maintain a strong, vigorous and healthy stand of grass. Lawn areas shall be mowed to a height of 2 inches whenever the average height of grass is over 3 inches. When the amount of cut grass is heavy, it shall be removed to prevent the destruction of the underlying turf.

B. Seeded or sodded areas that are determined to be dead within warranty period, or in the opinion of the Architect, in an unhealthy, unsightly, or badly impaired condition, shall be replaced by the Contractor as soon as reasonably possible after the unsatisfactory condition has been evident. No replacement shall be made in any season definitely unfavorable for seeding or sodding. Such replacements shall be made in the same manner as specified for the original seeding or sodding.

C. Seeded Lawns: Seeded lawns shall be protected and maintained by watering, mowing and replacing for 60 days or as long as may be necessary to produce a uniform stand of grass. After grass is up, it shall be top-dressed with organic lawn fertilizer. Maintenance shall continue until a uniform turf is established. For the purpose of establishing an acceptable standard, scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum of 3 percent of the lawn area. Areas not meeting this requirement will be reseeded.

D. Sodded Lawns: Sodded lawns shall be protected and maintained for 30 days or as long as necessary for the roots to be firmly established.

E. Surface Application of Fertilizer: Spread a second application of organic lawn fertilizer at the end of the maintenance period for both seeded and sodded lawns. Spreading rate shall be as recommended by the manufacturer.

    1. Sodded Areas: Use 18-5-9 or 12-4-8.
    2. Seeded Areas: Use 18-5-9 or 24-6-8.

        a. The second application of fertilizer shall be witnessed by the Owner or his representative, and a signed document shall be submitted to the Architect certifying the Work has been performed. The document shall be signed by the installer and the Owner's or Architect's witness.

F. Provide labor and equipment for maintenance, including the necessary watering and mowing equipment to meet the requirements herein established.

    1. The Owner will furnish the water used to maintain the lawns as specified.

G. Turf must have had a minimum of three (3) mowings before a request for acceptance can be considered.

H. Initial inspection of the seed or sod work to determine Substantial Completion of the work will be made by the Architect upon written notice requesting such inspection submitted by the Contractor at least 10 days prior to the anticipated date of inspection. Request may be made subsequent to the third mowing of the turf.

I. Acceptance: After inspection, the Contractor will be notified in writing by the Architect/Engineer of Substantial Completion of all work, or, if there are any deficiencies, of the requirements for completion of the work. Work remaining to be done or redone will be subject to re-inspection before Substantial Completion is given.

J. All seeded and sodded areas shall be guaranteed for a period of one full year / one complete growing season, commencing with the date of Substantial Completion.

K. Upon Substantial Completion, the Owner will assume general responsibility for maintenance of the lawn areas. The Contractor shall, however, make monthly visits to the site during the guarantee period to advise the Owner of proper maintenance procedures. No additional payment shall be made for visits. Price bid for the work of this trade shall include costs of visits.

L. Failure of the Contractor to notify the Architect/Engineer, in writing, of inadequate maintenance by the Owner of the lawn areas installed under this contract shall constitute acceptance of the Owner's maintenance operations by the Contractor. The Contractor shall not, therefore, use the Owner's alleged lack of proper maintenance as a basis for voiding his responsibilities under the guarantee herein specified.

M. At the expiration of the guarantee period, upon written request of the Contractor, inspection for Final Acceptance will be made by the Architect/Engineer. All remedial work to turf areas by the Contractor shall be completed prior to the request for Final Acceptance.

3.11 GUARANTEE / REPLACEMENT

A. The Contractor guarantees, by acceptance of the Contract that all work installed will be free from any and all defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified. If, during the period of one (1) year, or as otherwise specified, from date of the certificate of completion and acceptance of the work, should any defects in workmanship, material or performance appear, he will, without cost to the Owner remedy such defects within a reasonable time to be specified in writing by the Architect. In default thereof, the Owner may have such work done and charge cost to the Contractor.

B. The Contractor shall provide the Architect a written guarantee covering fully the one (1) year guarantee period. Lawns shall be warranted for the minimum duration of one full year, to include one full growing season after seeding and sodding, and shall be alive and in satisfactory growth at the end of the warranty period. The growing season is defined as beginning May 1 and ending October 1.

C. At the expiration of the guarantee period, upon written request by the Contractor, inspection for Final Inspection will be made by the Architect. All remedial work to seeding by the Contractor shall be completed prior to the request for final inspection. If lawns do not show a healthy, uniform stand of grass, those areas shall be re-seeded or re-sodded as soon as conditions permit, but during the spring or fall seeding periods.

D. Owner's Responsibility: If an area of seeding or sodding during the warranty and replacement period is found to be damaged or destroyed due to vandalism, malicious mischief, vehicle ruts and tracks, or acts of God such as flooding, storm debris, etc., then the Owner shall have the responsibility of replacing those lawn areas without cost or responsibility to the Contractor.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 329219 – SEEDING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Grass Seed Mixture

B. Preparation of subsoil

C. Placing Topsoil

D. Hydroseeding, Mulching and Fertilizer

1.02 RELATED SECTIONS

A. Section 310000 – Earthwork
B. Section 329400 – Plant Maintenance

1.03 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture(s).

1.05 DELIERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers or bags. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.06 SUMITTALS FOR REIVEW

A. Submittals shall be in accordance with Section 013300.

B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

PART 2 – PRODUCTS

2.01 SEED MIXTURE

A. Seed Blend shall have the following composition,

1. Kentucky Blue Grass: 40 percent, three (3) varieties, minimum.

2. Perennial Rye Grass: 60 percent, three (3) varieties, minimum.

2.02 TOPSOIL

A. Topsoil provided for grass seed growing media shall be in strict accordance with Section 310000 – Earthwork.

2.03 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Organic Type; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is properly graded and ready to receive the work of this Section.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 310000 – Earthwork.

B. Place topsoil in accordance with Section 310000 – Earthwork.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.04 HYDROSEEDING

A. Apply seeded slurry with a hydraulic seeder at a rate of 7 lbs per 1000 sq. ft., evenly in two intersecting directions.

B. Do not hydroseed area in excess of that which can be mulched on same day.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate top 4 inches

of soil.

E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches in area.

3.05 MAINTENANCE

A. Maintain all seeded areas in accordance with Section 329301 - Plant Maintenance.

B. Protect all seeded areas with warning signs and flagging tape during maintenance period.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 329219.11 – NATIVE PLANT SEEDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section is subject to all applicable provisions of the "General Conditions" and "Supplementary General Conditions", which form a part hereof whether attached hereto or not.

B. Under this item, the Contractor shall furnish and install topsoil, lawns and grasses in accordance with the plans, specifications, and as ordered by the Architect. This Contract includes all work of this Trade for a complete coordinated job, in order to provide an acceptable stand of turf by creating a rootzone mixture with seed or sod, including **decompaction of existing 12" of existing play field surfaces**, grading, topdressing, placing topsoil, soil amendments and sod, in accordance with the drawings as specified. The Contractor recognizes that the Plans and Specifications which form a part of this Contract reflect the overall intention and functional purpose, but that in all aspects the detailed Plans and Specifications might not be complete, but the Contractor does include as part of this work any and all provisions whether or not shown, to make his work under this Contract complete in every respect and to make any and all systems that he is responsible for complete system and to be in accordance with all authorities having jurisdiction.

C. Furnish all labor, material and appurtenance required for the installation of Topsoil and Seed as shown on the drawings and/or as herein specified. In general, the work shall include but not necessarily be limited to the following:

1. Decompaction of existing 12" of existing play field surfaces, and placing (fine-grading) of topsoil as required for seeding.

2. Seeding, sodding and establishing permanent grass lawns or swale areas.

3. All other work required to complete the work of seeding, sodding and related items as shown on the drawings and as herein specified.

4. Establishment, protection, maintenance, clean-up and replacement of lawns as required under the specified guarantee.

D. The work must comply with the requirements of the following related specifications sections:

1. Section 013563 "LEED Requirements" for additional LEED requirements (For LEED Certified Projects)

2. Section 017419 "Construction Waste Management" for recycling construction waste (For LEED Certified Projects)

E. Section 310000 – Earthwork

F. Section 312500 – Erosion and Sediment Controls

1.02 SHOP DRAWINGS, SUBMISSIONS AND APPROVALS

A. All submissions shall be in accordance with Section 013300 submission requirements.

B. Submit manufacturer's product data for each material or accessory to be utilized in association with the work of this section. Include MSDS sheets for all fertilizers and limestone.

C. Submit topsoil certifications and test reports.

D. Within seven (7) calendar days after awarding of the Contract, submit the following:

1. List of all materials, equipment, and manufacturers proposed to be furnished. Shop drawings will not be reviewed prior to approval of the list of manufacturers.

2. List of name of any subcontractors to be used for approval.

E. Interim and final as-built surveys; reference Quality Assurance section below and Specification Section 017839.

F. **LEED Submittals: For LEED Certified Projects: Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 "LEED Requirements".**

1.03 REQUIREMENTS / QUALITY ASSURANCE

A. The Contractor shall provide his own Engineer and/or Licensed Surveyor for establishing all topsoil and seed limits in the field and grades as required to meet the requirements of the Contract Documents.

1. For athletic fields: Upon completion of subgrade, prior to laying topsoil, the contractor shall provide an interim topographical survey in the datum of the Construction Documents for review for conformance by the Architect. Spot elevations on said survey shall be in complimentary locations to the Construction Drawings.

B. Notice of Sources: Within 10 days following award of Contract, the Contractor shall notify the Architect of the sources of the materials required; they may be inspected and tested if desired by the Architect.

C. Topsoil Testing: The Contractor shall take samples of the topsoil and have tests made to determine the appropriate proportions of supplements necessary for properly conditioned material (such as "Quick Test" to determine if lime should be used). Methods used shall be as approved by the Association of Agricultural Chemists or the State Agricultural Experiment Station. Preparation work necessary to bring the topsoil into proper condition to receive seeding shall be made in accordance with said tests at no additional cost to the Owner. Copies of said tests and recommendations are to be submitted to the Architect for approval prior to starting the Work of this Section.

D. Seeds: Packages of seed shall bear official State or Federal stamps and certificates indicating the type, quality, and content of the seed packages. Deliver packages unopened.

1.04 VERIFYING CONDITIONS

A. The Contractor shall examine all drawings which may affect the work of this section or require coordination by same.

B. Before starting any work, examine existing conditions and thoroughly check all drawings, specifications, adjoining or underlying conditions in which the work of this section is to be performed, and all dimensions.

C. Report in writing to the Architect any and all conditions which may interfere with or otherwise affect work of this section.

D. Seeding operations shall be conducted under favorable conditions during the next season or seasons which are normal for such work as determined by accepted practice in the locality of the Project.

1.05 PROTECTION OF WORK

A. Landscaped areas shall be protected by the Contractor against traffic damage, erosion, or other use by erecting barricades or temporary fencing immediately after seeding is completed and by placing warning signs of a type approved by the Architect on various areas. These barricades, or temporary fencing, and signs shall be maintained until the lawns are well established.

B. The Contractor shall maintain all seeded areas without additional payment until the expiration of the maintenance period. Any areas that fail to show a uniform stand of grass will be reseeded and re-fertilized at the Contractor's expense, until an acceptable stand of grass is established.

C. Upon final acceptance of the work specified herein, the Contractor shall remove all barricades or temporary fences.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil: Stockpiled topsoil may be used, provided it meets the requirements of these specifications. Additional topsoil from certified off-site sources shall be used, provided it meets the requirements of these specifications. Topsoil for lawn and planting operations shall be fertile, friable, natural loam containing a liberal amount of humus. It shall be free of admixtures and subsoil and shall be reasonably free of noxious weed, seed, lumps, plants, or their roots, and completely free of stones, sticks, and other extraneous matter, and shall not be used for planting operations while in a frozen or muddy condition. After spreading to a uniform depth of 6" minimum, all topsoil shall be raked to remove all extraneous matter. Raked topsoil shall conform to the mechanical analysis specified below and shall be free of stones, lumps, plants or their roots, sticks and similar debris, or any other undesirable material. Topsoil shall not be used in a muddy or frozen condition.

1. All topsoil to be furnished shall be subject to the approval of the Architect. Furnish a certified analysis, made by a recognized authority, of any topsoil that may have to be furnished to complete the work of this section. Test reports shall match the format listed below.

2. Topsoil shall have an acidity range of pH 5.0 to 7.0 and shall contain not less than 6 percent organic matter as determined by loss on ignition of moisture-free samples dried at 100 degrees centigrade. The mechanical analysis of the soil shall be as follows:

Passing	Retained On	Percentage
1" screen		100%
1" screen	¼" screen (gravel)	Not more than 3%
¼" screen	No. 100 USS mesh sieve (sand)	40%-60%
#100 USS	(Very fine sand, silt & clay)	40%-60%

3. Topsoil in which more than 60 percent of the material passing the USS No. 100 mesh sieve consists of clay as determined by the Pouyoucous hydrometer or by the decantation method, shall not be used. All percentages are to be based on dry weight samples. The chemical and mechanical analysis shall state the above items in correct quantities.

4. The Architect reserves the right to take samples of the topsoil from time to time, whether delivered to or stored at the site. These samples will be analyzed for comparison with the

Specifications. Should tests show that topsoil does not comply with the Specifications, the material may be rejected or such other remedy made as approved by the Architect in the form of the addition of humus or other supplemental materials.

5. The topsoil mixture materials shall be thoroughly mixed by hand or by rotary mixer to the satisfaction of the Architect.

B. Sand: Sand shall be ASTM C-33 concrete sand. The sand shall have a fineness modulus of 2.5-3.2 and a coefficient of uniformity of less than 4.

C. Ground Limestone: Ground Limestone (calcium carbonate) shall have the following analysis: at least fifty (50) percent shall pass a 200 mesh sieve; at least ninety (90) percent shall pass a 100 mesh sieve; and one hundred (100) percent shall pass a 10 mesh sieve. Total carbonate shall not be less than eighty-five (85) percent for purposes of calculation, total carbonate shall be considered as calcium carbonate.

D. Organic Fertilizer: Organic fertilizer shall be used for surface application after grass has germinated. Organic activated fertilizer shall contain the following percentage by weight: 5% minimum of nitrogen, 45% phosphoric acid, and other nutritious basic elements.

E. Chemical Fertilizer: Commercial fertilizer shall be used for initial preparation and shall conform to the applicable state fertilizer laws. Commercial fertilizer shall be a complete fertilizer and shall be an organic based product suitable for the establishment of the turf and grass species described herein and/or as noted on the Contract Plans. Examples of acceptable products and Suppliers/Manufacturers are: *PRO-GRO* by *North Country Organics* of Bradford VT., Ph. (802) 222-9661; *LAWN BOOSTER* by *Organica Inc*. of Norristown PA., Ph. 1-888-24GREEN, or locally at (631) 544-0348.

1. Application rate, sequence, and methods shall be as recommended by the manufacturer based on soil conditions of the areas of installation as tested by the Contractor, and on the intended grass stand character (i.e. turf area). The Contractor shall coordinate the review of the recommendations between the Architect, the Manufacturer, and the Contractor's Installer. Commercial fertilizer application shall be properly coordinated with the application of any other soil amendments that may be necessary.

F. Humus / Compost: Humus shall be of native type and consist of reed peat or sedge peat, but not peat moss, and of such physical condition that it can be readily incorporated with topsoil. It shall be free from sticks, stones, weedy roots, glass or toxic substances or other foreign matter. When delivered from stock piles, humus shall contain between 35 percent and 50 percent moisture. Use only natural domestic humus suitable for soil mulch and of such composition as to furnish ample water holding capacity and retention of plant food. Humus shall be dark brown to black in color, granulated, free of weed seed and lumps and show analysis as follows:

1. 25 percent - 45 percent moisture by weight as delivered from stockpile.
2. 5.0 - 7.5 pH (acidity).
3. Minimum 300 percent water absorbing ability (oven dried at 100 C.).
4. 85 percent minimum organic matter on dry basis (samples dried at 65 C.).
5. Low in content of wood material, suphur, iron, or other heavy metals.
6. Ash, on dry basis: not more than 10 percent.
7. Soluable salts less than 4.0.
8. Solvita Maturity number between 6 and 8.
9. Carbon / Nitrogen ratio - greater than 30:1.
10. Particle size shall pass a ¼" screen.
11. Low phosphorous and nitrogen content.

Humus shall be obtained from fresh water site, conditioned in storage piles after excavation for at

least 6 months, including one freezing, thawing period.

Certification and Testing: The Contractor shall submit a certificate of materials regarding the composition of the compost from a certified Seal of Testing Assurance Program, Compost Testing Program Laboratory. The test shall be for the actual material to be used on the project, from the stock piles. Stock piles of this material shall be visited by the Landscape Architect, with all expenses paid for by the Contractor.

One such laboratory is located on Long Island:

SOIL FOODWEB NEW YORK, INC.
555-7 Hallock Avenue
555-8 Port Jefferson Station, NY 11776
Phone: (631) 474-8848
Fax: (631) 474-8847
info@soilfoodwebnewyork.com

G. Mulch: Weyerhauser “Silva-Fiber”, or equal, available from American Excelsior Corporation, Chicago, Illinois.

H. Erosion Control Blanket: Use “Ero-Mat, standard”, as manufactured by Verdyol and distributed by Erosion Control Systems, Inc., Tuscaloosa, Alabama; (1-800-942-1986). Install with 11 gauge or heavier steel wire staples with 6 inch long legs and a 1 inch crown. Note: “Ero-Mat, High Velocity” for use on slopes greater than 3:1 and 60 ft. long; or in areas where a high velocity of water is expected - duration is 4-1/2 to 5 feet/second range (in swales).

I. Water for Turf Establishment: Water suitable for turf establishment will be available on-site to the Contractor as coordinated with the Owner. The Contractor shall provide all devices required for the distribution of water (provided by Owner) until turf is fully established. If an irrigation system has been installed or is already in place, this shall serve for distribution. The proper amount and frequency of watering will be the responsibility of the Contractor. In general terms, during dry weather, grassed areas shall be watered daily with sprinklers until grass is firmly rooted.

J. Grass Seed: The Contractor shall furnish and place all materials required for seeding in all topsoiled areas. The seed used shall be fresh, re-cleaned seed of the latest crop, mixed in the following proportions by weight, and meeting the following standards of pure live seed content. The tolerance for PLS (purity x germination) shall be those called official and tabulated on page 5, US Department of Agriculture Bulletin No. 480.

Grass seed mixes shall be as noted below. Submit mix percentages for approval. Percent pure live seed (PLS) shall be 95% minimum. Maximum percent weed seed shall be .50%. Germination shall be 85% or better.

All seed shall be delivered in the original packages, unopened, which shall include a guaranteed analysis by the vendor. The seeds shall be pre-mixed prior to delivery to the job site, or as otherwise directed by the Architect. The grass seed shall be of the latest crop, mixed in the following proportions by weight:

70% - Tall Fescue
20% - Turftype Ryegrass
10% - Kentucky Bluegrass

All seed shall exhibit minimum 98% Purity and minimum germination of 90%.

Unless specifically indicated otherwise above, the following varieties of turfgrasses shall include:

Tall Fescue: Rebel, Falcon, Mustang, Jaguar, Houndog.
Turftype Ryegrass: Manhattan II, Prelude, Palmer, Omega, Regal.
Kentucky Bluegrass: Eclipse, Adelphi, Glade, Sydsport, Baron.

The rate of seeding shall be as recommended by the supplier/manufacturer for the type of seeds used in the mix and the intended purpose of the planted area. The intent of the Restored Lawn Area seeding is to provide turf lawn to blend in with the areas adjacent to the disturbed area being planted. Supplier shall coordinate the final rate with the Architect, who shall have final authority for approval. Grass seed shall be sown in the fall from August 25 to October 1, or in the spring, between March 15 and May 1. Seeding shall be done in dry or moderately dry soil, and at times when the wind velocity does not exceed 5 mph.

Sowing of Seed: Immediately before any seed is to be sown, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable and of uniformly-fine texture. Lawn areas shall be seeded evenly with a mechanical spreader, at a rate of 10.0 pounds to 1,000 sq.ft. of ara, lightly raked, rolled with a 200 pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor to establish a smooth, uniform turf composed of the grasses specified. Re-seeding shall be done in accordance with this procedure.

Grass seed shall be sown in three different passes by approved machine in such a manner that a uniform stand will result. After seeding, the surface shall be evenly raked with a fine toothed rake and rolled with an approved roller, as directed by the Architect. Seeding by hydraulic means may be used if approval is obtained from the Architect.

1. The mixture of grass seed from which the sod was grown shall consist of approximately the following mixture of permanent grasses: 70% Tall Fescue, 20% Turftype Ryegrass, 10% Kentucky Bluegrass - or - 50% shade tolerant Kentucky Blue Grass - 20% Manhattan II Rye Grass - 30% Pennlawn Fine Fescue (blend as selected by the Architect). All sod shall be inspected prior to delivery.

2. Sod shall be harvested, delivered and transplanted within a period of 36 hours. Before cutting, sod shall be mowed uniformly at a height of 1-1/2 inches.

3. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section.

4. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

5. Thatch: Sod shall be relatively free of thatch up top ¼ inch allowable (uncompressed).

6. Diseases, Nematodes and Insects: Sod shall be reasonably free of diseases, nematodes and soil-borne insects.

7. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than two (2) such plants are found per 200 s.f. of area. Sod will not be acceptable if it contains any of the following weeds: common Bermuda grass (wire-grass), quackgrass, johnsongrass, poison ivy, nutsedge, niblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel and bromegrass.

8. Architect/Engineer may inspect the sod before it is harvested, but reserves the right to reject, on or after delivery, any sod which in his opinion does not meet with the specification requirements.

K. Rootzone Mix Ratio: The rootzone mix shall utilize all existing topsoil stockpiled and shall incorporate an additional 3" of sand and 1" of compost at no additional cost to contract.

L. Topdressing: The entire portion of the field not being repaired for low spot filling shall receive a full ½" of topdressing using organic matter which shall be a mature, stable compost with an organic matter content of 6-8% and be free of glass or toxic substances. This material is available from *Agresource*, called *Agresoil Compost*, and is made from bio solids, not leaf mold. Contact number: 1-800-313-3320.

M. Overseeding: Overseeding shall be accomplished by a drill seeder in three different passes using the following seed mixture:

Percent	Turfgrass Species / Variety	Min. Purity %	Germ. %
70%	Tall Fescue	98%	90%
20%	Turftype Ryegrass	98%	90%
10%	Kentucky Bluegrass	98%	90%

Acceptable varieties of each turfgrass shall include:

Tall Fescue: *Rebel, Falcon, Mustang, Jaguar, Houndog*.
Turftype Ryegrass: *Manhattan II, Prelude, Palmer, Omega and Regal*.
Kentucky Bluegrass: *Eclipse, Adelphi, Glade, Sydsport and Baron.*

Rate of seeding shall be 10 lbs. per 1,000 sq.ft. pf pure live seed (pls.).

PART 3 – EXECUTION

3.01 STRIPPING TOPSOIL

A. All topsoil shall be stripped as described and stockpiled for reuse. No topsoil is to be removed from the site.

3.02 GRADING AND SUBGRADE PREPARATION

A. Perform grading operations to bring subgrade to levels required and to contour indicated on the drawings.

B. Completed subgrade shall be approved by the Architect/Engineer before topsoil and sodding.

C. The approved subgrade shall be scarified to a depth of 2 inches to permit mixing with rootzone material.

D. Where work involved is not in an area designated for regarding, the existing grade shall be rototilled to a depth of 8 inches. The area shall then be leveled and stones raked out.

3.03 ROOTZONE / SEED BED PREPARATION

A. See Specification Section 329200 – Turf and Grasses

3.04 SEEDING OPERATIONS:

A. General:

1. Furnish all materials required for seeding lawn areas in topsoiled areas.

2. Prior to seeding operations, all areas to be seeded shall be thoroughly disked or otherwise loosened to a depth of 4 inches and shall be carefully raked to true lines free from all unsightly variations, bumps, ridges or depressions, brought to finished grade elevations as shown on the drawings. All sticks, stones, roots or other objectionable material which might interfere with the formation of a finely pulverized seed bed shall be removed from the soil. Two pounds of 15-20-10 formula commercial fertilizer per cu.yd. shall be thoroughly mixed with the topsoil or not less than 10 lbs. per 1,000 sq.ft. of lawn surface, whichever is the greater.

3. Seeding:

    a. Purpose: To provide permanent vegetative cover and to control storm water run-off and erosion.

    b. Where Applicable: All areas not covered by buildings and pavement within the limit lines as shown on the contract plans, and all other existing lawn areas disturbed or damaged by the work of this contract.

4. All areas to be seeded in lawn shall be thoroughly disked or otherwise loosened to a depth of four (4) inches and shall be raked to true lines, free from all unsightly variations, bumps, ridges or depressions. As specified, all sticks, stones, roots or other objectionable material that might interfere with the formation of a finely pulverized seed bed shall be removed from the soil. Ground limestone, humus and commercial fertilizer shall be applied as specified:

5. Apply ground limestone uniformly at a minimum rate of 100 pounds per 2,000 square feet, or as determined by analysis. The ground limestone shall be distributed evenly, by machine, over all areas to be seeded. It shall be worked lightly into the top three (3) inches of the soil, at least five (5) days before applying fertilizer.

6. Apply fertilizer uniformly at a minimum rate of 10 pounds per 1,000 square feet. Fertilizer to be 10-10-10. Apply humus at the rate of 3-1/3 cubic yards per 1,000 square feet. Note: Application rate, sequence, and methods shall be as recommended by the manufacturer based on soil conditions of the areas of installation as tested by the Contractor, and on the intended grass stand character (i.e. turf area). The Contractor shall coordinate the review of the recommendations between the Architect, the Manufacturer, and the Contractor’s Installer. Commercial fertilizer application shall be properly coordinated with the application of any other soil amendments that may be necessary.

7. Work lime, fertilizer and humus into soil to a minimum depth of 3 inches using any suitable equipment.

8. The soil shall then be raked to a smooth, even draining surface and properly set and compacted to establish uniform lawn/grass growth with an approved roller or as otherwise directed by the Architect. Manipulate to form, after settlement, smooth draining grades as shown on the drawings. Any depressions which occur shall be re-graded and re-rolled until a satisfactory grade is obtained.

9. Time of Seeding: Grass seed shall be sown preferably in the fall between August 15th and October 1st or in the spring between April 1st and May 15th, or at such other times as are approved by Owner's Representative. All seeding is to be done in dry, or moderately dry soil and at times when the wind does not exceed a velocity of five miles per hour.

10. Seed shall be sown at the rate as recommended by the supplier/manufacturer for the type of seeds used in the mix and the intended purpose of the planted area. The intent of the Restored Lawn Area seeding is to provide turf lawn to blend in with the areas adjacent to the disturbed area being planted. Supplier shall coordinate the final rate with the Architect, who shall have final authority for approval. Grass seed shall be sown in the fall from August to October, or in

the spring, between March and May. Seeding shall be done in dry or moderately dry soil, and at times when the wind velocity does not exceed 5 mph. Grass seed shall be sown by approved machine in such a manner that a uniform stand will result. After seeding, the surface shall be evenly raked with a fine toothed rake and rolled with an approved roller, as directed by the Architect. Seeding by hydraulic means may be used if approval is obtained from the Architect.

B. Hydroseeding Option: The Contractor may utilize a hydroseeding option, as indicated above. If hydroseeding shall be supplied as a zero-cost option to the Owner, the Contractor shall supply the name, address and contact information of his hydroseeding subcontractor to the Architect for contact and discussion. The hydroseed blend to be submitted by the Contractor shall be equal and comparable to the standard seed blend(s) indicated within this specification section for the intended turf establishment. The blend shall be submitted to the Architect in advance as a part of the shop drawings submittal process.

3.05 MULCHING:

A. All seeded areas shall be covered with approved mulch not later than 3 days following seeding. Ground surfaces shall be completely covered at the rate of at least 2 tons an acre. The Contractor shall utilize a Bowie Hydromulcher or equal to apply all mulch.

B. All areas to receive permanent seeding shall be mulched as described in the specifications and as noted herein.

C. On slopes 4 horizontal to 1 vertical, or greater, and in drainage swales, mulch shall be anchored using erosion control blanket or other approved netting properly fastened in place. Install rolls in proper direction with overlap and staple pattern set in accordance with the manufacturer's requirements.

D. In any event, the Contractor is responsible for mulch remaining intact until grass has germinated and has reached a minimum height of one inch.

3.06 WATERING

A. The Contractor shall be responsible for the proper watering for all sodded areas until Substantial Completion of the work as hereinafter specified. The proper amount and frequency of watering will be the sole responsibility of the Contractor.

B. In the absence of adequate rainfall, watering shall be performed daily during the first week, and shall be sufficient to maintain moist soils to a depth of at least 5 inches. Water should be applied immediately if at any time the sod shows indications of wilting.

C. Subsequent Watering: Sod shall be watered as required to maintain adequate moisture in the upper 5 inches of soil. In the absence of rainfall, sod shall be watered at frequencies dictated by need.

3.07 CLEAN-UP

A. Soil, manure, peat or similar material which has been brought onto paved areas by hauling operations or otherwise shall be removed promptly, keeping these areas clean. Upon completion of the planting, excess stones and debris, which has not been previously cleaned up, shall be removed from the site or disposed of as required by the Architect, except topsoil shall be spread or piled on the site as directed by the Architect. Lawns and planting areas shall be prepared for final approval.

3.08 MAINTENANCE, REPLACEMENT, GUARANTEE AND FINAL INSPECTION:

A. Maintenance operations shall begin immediately after the seed is sown/sod installed and shall be continued as required until Substantial Completion. Grass shall be kept in healthy growing condition by mowing, watering, weeding, cultivating, disposal of waste vegetation, fertilizing, spraying or spreading of approved materials to prevent or treat infestations of insects or disease and all other operations required to produce and maintain a strong, vigorous and healthy stand of grass. Lawn areas shall be mowed to a height of 2 inches whenever the average height of grass is over 3 inches. When the amount of cut grass is heavy, it shall be removed to prevent the destruction of the underlying turf.

B. Seeded or sodded areas that are determined to be dead within warranty period, or in the opinion of the Architect, in an unhealthy, unsightly, or badly impaired condition, shall be replaced by the Contractor as soon as reasonably possible after the unsatisfactory condition has been evident. No replacement shall be made in any season definitely unfavorable for seeding or sodding. Such replacements shall be made in the same manner as specified for the original seeding or sodding.

C. Seeded Lawns: Seeded lawns shall be protected and maintained by watering, mowing and replacing for 60 days or as long as may be necessary to produce a uniform stand of grass. After grass is up, it shall be top-dressed with organic lawn fertilizer. Maintenance shall continue until a uniform turf is established. For the purpose of establishing an acceptable standard, scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum of 3 percent of the lawn area. Areas not meeting this requirement will be reseeded.

D. Surface Application of Fertilizer: Spread a second application of organic lawn fertilizer at the end of the maintenance period for both seeded and sodded lawns. Spreading rate shall be as recommended by the manufacturer.

    1. Sodded Areas: Use 18-5-9 or 12-4-8.
    2. Seeded Areas: Use 18-5-9 or 24-6-8.

        a. The second application of fertilizer shall be witnessed by the Owner or his representative, and a signed document shall be submitted to the Architect certifying the Work has been performed. The document shall be signed by the installer and the Owner's or Architect's witness.

E. Provide labor and equipment for maintenance, including the necessary watering and mowing equipment to meet the requirements herein established.

    1. The Owner will furnish the water used to maintain the lawns as specified.

F. Turf must have had a minimum of three (3) mowings before a request for acceptance can be considered.

G. Initial inspection of the seed or sod work to determine Substantial Completion of the work will be made by the Architect upon written notice requesting such inspection submitted by the Contractor at least 10 days prior to the anticipated date of inspection. Request may be made subsequent to the third mowing of the turf.

H. Acceptance: After inspection, the Contractor will be notified in writing by the Architect/Engineer of Substantial Completion of all work, or, if there are any deficiencies, of the requirements for completion of the work. Work remaining to be done or redone will be subject to re-inspection before Substantial Completion is given.

I. All seeded and sodded areas shall be guaranteed for a period of one full year / one complete growing season, commencing with the date of Substantial Completion.

J. Upon Substantial Completion, the Owner will assume general responsibility for maintenance of the lawn areas. The Contractor shall, however, make monthly visits to the site during the guarantee period to advise the Owner of proper maintenance procedures. No additional payment shall be made for visits. Price bid for the work of this trade shall include costs of visits.

K. Failure of the Contractor to notify the Architect/Engineer, in writing, of inadequate maintenance by the Owner of the lawn areas installed under this contract shall constitute acceptance of the Owner's maintenance operations by the Contractor. The Contractor shall not, therefore, use the Owner's alleged lack of proper maintenance as a basis for voiding his responsibilities under the guarantee herein specified.

L. At the expiration of the guarantee period, upon written request of the Contractor, inspection for Final Acceptance will be made by the Architect/Engineer. All remedial work to turf areas by the Contractor shall be completed prior to the request for Final Acceptance.

3.09 GUARANTEE / REPLACEMENT

A. The Contractor guarantees, by acceptance of the Contract that all work installed will be free from any and all defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified. If, during the period of one (1) year, or as otherwise specified, from date of the certificate of completion and acceptance of the work, should any defects in workmanship, material or performance appear, he will, without cost to the Owner remedy such defects within a reasonable time to be specified in writing by the Architect. In default thereof, the Owner may have such work done and charge cost to the Contractor.

B. The Contractor shall provide the Architect a written guarantee covering fully the one (1) year guarantee period. Lawns shall be warranted for the minimum duration of one full year, to include one full growing season after seeding and sodding, and shall be alive and in satisfactory growth at the end of the warranty period. The growing season is defined as beginning May 1 and ending October 1.

C. At the expiration of the guarantee period, upon written request by the Contractor, inspection for Final Inspection will be made by the Architect. All remedial work to seeding by the Contractor shall be completed prior to the request for final inspection. If lawns do not show a healthy, uniform stand of grass, those areas shall be re-seeded or re-sodded as soon as conditions permit, but during the spring or fall seeding periods.

D. Owner's Responsibility: If an area of seeding or sodding during the warranty and replacement period is found to be damaged or destroyed due to vandalism, malicious mischief, vehicle ruts and tracks, or acts of God such as flooding, storm debris, etc., then the Owner shall have the responsibility of replacing those lawn areas without cost or responsibility to the Contractor.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 329300 – PLANTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section is subject to all applicable provisions of the "General Conditions" and "Supplementary General Conditions", which form a part hereof whether attached hereto or not.

1.02 RELATED SECTIONS

A. The work must comply with the requirements of the following related specifications sections:

1. Section 013563 “LEED Requirements” for additional LEED requirements (For LEED Certified Projects)
2. Section 017419 “Construction Waste Management” for recycling construction waste (For LEED Certified Projects)
3. Section 310000 – Earthwork
4. Section 312500 – Erosion and Sediment Controls
5. Section 322700 – Site Furnishings

1.03 SCOPE OF WORK

A. Planting required for this Work is indicated on the Plans and includes furnishing and planting all trees, shrubs, hedges and ground cover throughout the Work. Work shall also include, but not be limited to: Tree Staking, Mulching, Maintenance, warranty and replacement of plants, aluminum edgings, weed barrier, finish grading of associated planting areas, providing and preparing soil and soil mixes per agronomic soil test recommendations. Under this item, the Contractor shall excavate all tree pits included and shall furnish, plant, and maintain all plant materials specified or as directed by the Architect. The Contractor shall be liable for any damages caused by planting and/or transplanting operations and all areas and construction disturbed shall be restored in their original condition to the satisfaction of the Architect. Any plantings that do not establish themselves during the warranty period shall be replaced at no additional cost to the Owner.

1.04 REQUIREMENTS AND QUALITY ASSURANCE

A. Each plant supplied shall be as designated in the Landscape Schedule which is shown on the Contract Drawings.

B. Plant names shall agree with nomenclature of "Standardized Plant Names", as adopted by the American Joint Committee on Horticultural Nomenclature, current edition, size and grading standards shall conform to those of the American Association of Nurserymen (AAN) unless otherwise specified. No substitution shall be permitted except by written permission of the Architect upon adequate documentation in writing from three (3) sources of the unavailability of material specified.

C. The quality of all plants shall be typical of their species or variety, and in accordance with American Standards of Nursery Stock – ANSI Z60.1-latest version by AAN. They shall have normal, well developed branches and vigorous root systems. Each tree or shrub shall show a normal habit of growth, and show no physical damage. They shall be free of fibrous defects, disfiguring knots, sun-scaled injuries, abrasions of the bark, plant diseases, insect eggs, bores and all forms of infestations. All plant shall be nursery-grown unless otherwise stated; they shall have been growing under the same climatic conditions as the location of this project for at least two years prior to date

of planting on this project. They shall conform to the dimensions specified, and shall present a balanced proportion of height and spread for the particular specimen desired. The Contractor may be required to certify to the patented varieties of trees specified in this Contract.

D. The work of this section shall include the cost of excavating plant pits, including disposal of excess subsoil, installation of a porous weed barrier, furnishing plants, transplanting plants, digging and transporting trees from nurseries, furnishing and placing topsoil for pits, inspecting, planting, pruning, staking, guying, anchoring, wrapping, watering, restoration, replacement of nursery stock which does not establish itself in conformance with warranty requirements, and maintaining all trees, incorporating super-phosphate with the topsoil, distribution fertilizer over plant pits and all other work, incidentals thereof, in accordance with the specifications to the satisfaction of the Architect.

E. Inspection of Plant Materials:

1. All plants shall be subject to inspection at any time and place. Inspections desired by the Contractor, if approved, shall be at the expense of the Contractor. All trees and shrubs shall be subject to inspection and approval and marking at the growing site, but approval and marking at the growing site shall not obligate the Owner to pay for any tree or shrub until it has been delivered and planted at the planting site in a satisfactory condition. The Contractor shall be represented at all inspections. The Architect reserves the right and option to place seals on plant materials selected. Selection and/or tagging shall not constitute final acceptance nor preclude the right of rejecting plants not fully meeting the requirements of the Specifications.

2. The Architect reserves the right to identify by suitable non-injurious means, such as painting, marking by various methods, etc., all plant material rejected upon delivery to the contract site.

3. All plants are subject to inspection and approval at point of origin. To this effect, when requested by the Architect, the Contractor shall designate the plant material at the nursery that is to be planted in this Contract in the presence of the Architect. The Architect shall, at his option, tag each plant selected. Plant material not meeting specification requirements will be rejected at the nursery, and material tagged at the nursery arriving untagged at the site will also be rejected. No tags shall be removed until after planting.

4. Plant material shall be subject to inspection upon delivery to site, tagging not withstanding. No plant material shall be planted until inspected and approved. Any rejected plant material shall be immediately removed from the site and replaced with acceptable plant material at no additional cost to the Owner. The removal of nursery stock rejected at the planting site shall be at the expense of the Contractor and replacement in compliance with specifications shall be made at no extra cost to the Owner. The Owner reserves the right to inspect and tag plant materials for replacement which have died during the maintenance and guarantee period. The above standards shall apply.

F. Plant Material Replacement: The Contractor shall replace in accordance with the Contract Plans and Specifications any plant material that are dead or, in the opinion of the Architect, are in an unhealthy or unsightly condition, and/or excessive pruning, inadequate or improper maintenance, or other causes, by the date of one (1) year after the final acceptance and completion of the whole work of this Contract.

1. Where vandalism is agreed by the Architect as the cause for replacement, the Contractor shall not be responsible for replacement during the guarantee period after Final Acceptance.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's current product literature for each manufactured product specified herein. Include maintenance instructions recommending procedures to be established by

the Owner for maintenance of landscaping during an entire year.

B. **LEED Submittals: (For LEED Certified Projects) Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 "LEED Requirements".**

1.06 PRODUCT HANDLING AND DELIVERY

A. For delivery, all plants shall be packed, transported, covered when delivered in open trucks, and handled with utmost care to insure protection against injury. During shipment they shall be protected by tarpaulin, burlap or other suitable covering so as to prevent dehydration. The tops of trees and shrubs shall be tied in with heavy twine to protect branches from being broken during loading, shipping and unloading. Each shipment shall be certified by State and Federal authorities to be free from disease and infestation. All balls of the trees or shrubs delivered to the site in a loose, broken or dried condition will be rejected.

B. Any inspection certificate required by law to this effect shall accompany each shipment invoice or order of stock. On arrival, the certificate shall be filed with the Architect. Balled and burlapped plants shall be set on the ground and the balls covered with moist soil, mulch or other protection from drying winds and sun. Until planted, all plant material shall be properly maintained to the satisfaction of the Architect. Water as required to maintain good health and growth. Protect all plant materials (either in place, or awaiting planting)from freezing.

C. Plants delivered to the contract site shall be planted within 72 hours from time of delivery. All others will be rejected and promptly removed from the site. If, due to no fault of the Contractor, he is unable to plant in a specified area, such as other Contractor's operations, wet soil conditions, or inclement weather, the Contractor shall take the necessary steps to heel in the plant material with wood chips or salt hay, to the satisfaction of the Architect. Any bare-rooted plants shall be planted or heeled-in immediately upon delivery. Planting of delayed areas shall proceed as soon as acceptable conditions present themselves.

1.07 MEASUREMENT

A. Measurement of sizes for various trees shall be in accordance with those specified in the publication "*American Standard for Nursery Stock*" by the *American Association of Nurserymen, Inc*., 230 Southern Building, Washington, DC 20005, approved as USA Standard Z60.1-1973 by American National Standards Institute, Inc., latest edition.

1.08 ABBREVIATIONS

A. Cal. - indicates the caliper of the trunk of the tree.

B. B.R. - indicates plants to be dug out with bare roots.

C. B&B - indicates plants to be balled and burlapped.

D. C.G. - indicates container-grown plants.

PART 2 - MATERIALS

2.01 PLANT MATERIAL

A. Each plant supplied shall be as designated in the Landscape Schedule and meeting the description under Standards of this Specification. For measurement purposes, a plant shall be dimensioned as it stands in its natural position. Trees shall be calipered six (6) inches above ground. Stock

furnished shall be a fair average of the minimum and maximum sizes specified. Large plants cut back to size specified will not be accepted.

B. Locate plants as shown on the Contract Drawings, except where obstructions below ground or overhead are encountered or where changes have been made in the construction. Make necessary adjustments only after approval of the Architect. Place no planting, except ground cover and vines, closer than 2 feet to pavements or structures.

C. Furnish quantities necessary to complete the planting as shown and located on the Contract Drawings. The Contractor may, at his option, elect to furnish items designated as alternates in the Plant List, provided that matched plantings are used where shown. In the event that alternatives are to be used, the Contractor shall so notify the Architect in writing and receive written approval from the Architect prior to delivery.

D. All plants shall have a habit of growth that is normal for the species and shall be sound, healthy, vigorous and free from insect pests, plant diseases and injuries. Plants shall equal or exceed the measurements specified in the Plant List, which are the minimum acceptable sizes. They shall be measured before pruning with branches in normal position. Necessary pruning shall be at the time of planting. Requirements for the measurement, branching, grading, quality, balling and burlapping of plants in the Plant List generally follow the code of standards currently recommended by the American Association of Nurserymen, Inc. in The American Standard for Nursery Stock.

E. Trees shall have straight trunks with the leader intact, undamaged, and uncut. Old cuts and abrasions shall be completely calloused over. Branching must be well-developed and not one-sided.

F. Plants are subject to observation for quality, size and color. Plants which are weak, sick or lacking compact and proper proportions will not be accepted. Plants shall not be pruned prior to delivery.

2.02 FERTILIZER AND SUPERPHOSPHATE

A. Superphosphate (18% - 20% phosphorous acid) shall be incorporated with the topsoil at the time of planting, at the following rates:

Two (2) pounds per 1" of caliper of tree.
One (1) pound per two (2) feet height of shrub.
Twenty (20) pounds per 1,000 square feet of ground cover bed.

1. Just prior to mulching of the plant materials, fertilizer (10-10-10, 50% organic nitrogen) shall be evenly distributed over the plant pit at the rate of one (1) pound per 1" of caliper of tree, one-half (1/2) pound per two (2) feet height of shrubbery and twenty (20) pounds per 1,000 square feet of ground cover bed.

2. Fertilizer shall be stored as required in such a manner that its effectiveness will not be impaired.

3. No fertilizer shall be delivered to the site until it is approved by the Architect, but such approval does not constitute final acceptance. The Architect reserves the right to reject on or after delivery any material which does not, in his opinion, meet these specifications. The bid shall include furnishing and delivery of the samples to approved Testing Laboratories, if required.

2.03 WOOD CHIP MULCH

A. Wood chips shall be obtained from green hardwood and shall be 1/8 inch nominal thickness with fifty (50) percent having an area of not less than one (1) square inch nor more than six (6) square inches and shall be free of leaves, twigs, shavings, bark and any foreign materials which are injurious to plant growth.

2.04 STAKING

A. Trees will not be staked unless directed so by the Architect; refer to Contract Drawings for specific staking requirements. If site conditions warrant staking in the opinion of the Architect, a double stake system that allows the tree to stand straight free of any support and allows flex of the tree due to any natural horizontal forces with return to its original vertical position will be used. This system shall be similar or equal to the "*Ready Stake System*" as manufactured by *Decorations for Generations*, 2224 So. Daubenberger Road, Turlock, California 95380, phone 1-888-333-3090; or approved equal. Refer to 3.02 for related information.

2.05 TOPSOIL

A. The topsoil shall consist of a fertile, friable, natural topsoil of loamy character, from the "A" Horizon without a mixture of subsoil, uniform in quality and shall be free from refuse of any nature, hard clods, sods, hard pan, pebbles larger than ¾ inch in diameter, coarse sand, noxious weeds, sticks, brush or other rubbish. Topsoil shall conform to all plan notes, specifications, and Town, Village or other Agency with jurisdiction, requirements. Topsoil used in planting shall be included in the price bid for the plant and at no additional cost to the Owner.

B. The topsoil shall contain not less than five (5) percent nor more than twenty (20) percent organic matter, as determined by loss on ignition of oven-dried samples.

C. The pH value of all topsoil shall be not less than five (5) and not more than seven (7). If, after testing samples of material, obtained from any source inside or outside the contract limits, the topsoil is found to be unsatisfactory for the intended use, the Architect may require that the Contractor, without additional compensation, add to the topsoil proposed by him for use, lime, particular fertilizer or particular humus, as directed, in order to make the topsoil suitable.

The sieve analysis of an oven-dried sample washed past the 100 sieve shall be as follows:

SIEVE SIZE	PASSING
1"	100%
¼"	80 to 100%
#100	40 to 60%

2.06 WRAPPING

A. Major tree trunks (in excess of 2" caliper) shall be securely wrapped with a six (6) inch new burlap bandage, securely tied at the top and bottom, and at two (2) foot intervals along the trunk of the tree, or krinklekraft paper from the bottom to the height of the lowest branches. Provide fifty (50) percent overlap with wrapping material. Both burlap and wrapping paper shall be securely tied with ties. Burlap shall be maintained in place until the end of the Guarantee Period, at which time it shall be removed by the Contractor.

2.07 EDGING

A. Edging to be one of the following:

1. Aluminum edging is to be 3/16 inch by 5-1/2 inch, complete with all stakes and connectors. Finish is to be electrostatically-applied enamel acrylic (baked-on paint); color is to be black. The following manufacturers are acceptable:

   a. "Black Dura-Flex" as manufactured by Permaloc Corp., phone: 1-800-356-9660.
   b. "Deco-Black" finish as manufactured by Curve-Rite Aluminum Edging; phone: 1-800-366-2878.
   c. "Sure-Loc Aluminum Edging" as manufactured by Sure-Loc Corp., Holland, Michigan;

phone: 1-800-787-3562.

2. Steel edging as manufactured by Ryerson Steel, subsidiary of Inland Steel Industries, Inc.; ¼ inch x 5 inches, allowing for 8 inch overlap, complete with 15 inch tapered steel stakes at 30 inches on center. Color as selected by the Architect.

PART 3 - EXECUTION

3.01 PLANTING

A. Time of Planting: Unless otherwise directed by the Architect, conduct planting operations under favorable weather conditions during the next season or seasons which are normal for such work as determined by accepted practice in the locality of the Project. Seasons for these plantings are: Spring planting – March 10 through May 10; Fall planting - August 20 through November 30. Upon written request by the Contractor to the Architect, an extension of the deciduous planting season for winter planting may be granted. Extension will be determined by the genus of trees to be planted and soil conditions.

B. Prior to planting, the Architect may adjust the location of any trees in the field as necessary. The Contractor shall notify the Architect if relocation may be necessary prior to proceeding. In general, all plants shall stand, after settlement, at the same level at which they have grown. Care shall be exercised in setting the plant plumb. Ropes, stones, etc., shall be removed from the hole before backfilling, and all soil for backfilling shall be loose and friable and not frozen.

C. Plants shall be planted plumb at the same level at which they have grown unless otherwise specified on the drawings. The balls of earth of balled and burlapped plants shall not be loosened or otherwise damaged during planting operations. All large and fleshy roots which are bruised or broken shall be pruned with a clean cut before planting. The burlap shall be cut away from upper half of ball and remaining burlap adjusted to prevent formation of air pockets. Soil shall be firmed thoroughly and settled by tamping and watering.

D. In digging the trees and shrubs with a rootball, the minim lateral diameter of the rootball shall be as specified. The rootball shall be of sufficient depth to include all lateral roots. All roots encountered during digging operations shall be cut flush to the side of the ball with sharp loging or pruning sheers. The rootball shall be firm and compact, tightly and adequately bound with burlap wrapping. Platforms will be required for the balls over six (6) feet in diameter to assure solidity of the ball. If trees are unloaded by a bucket loader machine of sufficient size, platforms may be eliminated with the approval of the Owner's Representative. Under no circumstances shall the rootball be artificially manufactured to meet size requirements and none will be accepted in a loose, broken or lopsided condition.

E. All trees and shrubs required by the specifications or plan to be moved with ball and burlap will be measured across the minimum lateral diameter of the rootball. The rootballs shall be wrapped and laced as shown in the 1973 American Standard Nursery Stock. Rope shall be a minimum of 3-ply sisal or approved equal.

F. All trees and shrubs that are required by the specifications or plans to be dug bare root shall have all fine fibrous roots preserved. After digging, the bare root plants shall be puddled in a heavy mixture of clay, mud and packed with straw or salt hay, held in a moist condition until planted.

G. Backfill shall be one part peat, three parts topsoil mixture. To the topsoil used in backfilling tree pits, thoroughly incorporate commercial raw bonemeal as follows:

3 pounds for minor trees and shrubs
5 pounds for evergreen trees

5 pounds for major trees 2 to 3 inches caliper
7 pounds for major trees 3 to 4 inches caliper

All components shall be pre-mixed before backfilling and peat shall be thoroughly moistened before mixing.

H. Trees shall be placed in the proper position in the center of the pit after the soil in the bottom of the pit has been firmed. Loose, friable topsoil shall be worked in, firmed at intervals and thoroughly settled with water. Care shall be taken to avoid bruising or breaking the tree ball when tamping the soil. All large and fleshy roots which are bruised or broken shall be pruned with a clean cut before planting.

I. The Contractor shall be responsible for placing the proper variety of tree or shrub at the locations as shown on the plans or in the distribution schedule of the proposal. If an error is determined by the Architect as described above, the Contractor shall replace the tree or shrub with the proper plant in the next succeeding planting season and maintain and guarantee of that tree or shrub for 1 year from the date of replacement.

J. The Contractor shall be responsible for locating all utility lines including traffic conduits, LIPA/National Grid Energy Delivery installations, irrigation systems, etc. The Contractor shall be responsible for repairing all damage to utilities.

K. Size of Pits:

1. The pit diameter shall be twice the root spread for plants up to and including a two foot root spread; pit diameter equal to root spread plus two feet for root spread of two to four feet; pit diameter one and one half times the root spread for spread of roots over four feet. The depth of pits shall be adequate to permit a minimum of six inches of topsoil backfill under all roots or balls. Where subsurface obstructions are encountered, the Contractor shall restore the disturbed area to its original condition. A new pit location will then be designated by the Architect.

2. The above applies for spread of roots of bare root plant and balled and burlapped plants.

3. Larger pits may be required, if so specified in the plans or specifications.

4. When designated on the plans as a planting bed, the depth of the bed for shrubs shall be 18" deep and the bed for ground covers shall be 12" deep. Depth of beds shall be taken from surrounding existing grades.

5. In curb strip grass areas, the tree pits shall be a minimum of 48" long and the widths shall be from the back of the curbs to the edge of the sidewalk, or where room allows the width shall be a minimum of 48" wide.

6. Disposal of Excavated Materials: Excess topsoil and subsoil excavation from tree pits and planting beds shall be disposed of off the site by the Contractor. Existing topsoil shall not be used for planting unless so directed by the Architect.

3.02 RELATED OPERATIONS & GENERAL PLANTING PROCEDURES

A. All shrubs and groundcover shall be backfilled with topsoil as per the plans and specifications.

B. Any required staking shall be done immediately after planting and all stakes and wires shall be maintained for one (1) year after completion of the Contract. Plants shall stand plumb after staking. One month prior to end of guarantee period, the Contractor shall remove all stakes, guy wires and

wrapping from plant material unless otherwise directed by the Owner. Removal and disposal of such shall be at the Contractor's expense, and the cost, therefore, included in the contract bid price.

C. Wood chip mulch shall be placed in saucers at least as large as the holes in which trees and shrubs have been planted to a depth of three (3) inches. If plant beds are shown on the drawings, it is an indication that these beds be mulched with a minimum of (3") three inches of wood chip mulch and fertilized according to manufacturer's recommendations for shrubs and ground cover. Shredded hardwood mulch is acceptable in lieu of wood chip mulch.

D. All trees and shrubs shall be set plumb and at such a level that after settlement they are recessed four (4") inches below the existing grade, forming a natural saucer. All trees and shrubs shall be backfilled to the crown with topsoil, supplied as specified. Topsoil shall be thoroughly and properly settled by tamping and by watering.

E. The contract price for planting shall include the furnishing of all topsoil necessary for planting operations.

F. Watering: At the time of planting, the soil around each plant shall be thoroughly saturated with water. All plants including shrubs and groundcover shall be watered by the Contractor once a week between the periods of April 1 and October 1, unless otherwise directed by the Architect. Each watering should be sufficient to adequately soak the plant root system. The Contractor shall be completely responsible for the initial watering during planting and maintenance period watering until the project receives Substantial Completion status by the Architect. At the determination of Substantial Completion, the Contractor’s one-year warranty period is established, and the Owner assumes full responsibility for routine maintenance, including watering as required by field conditions.

G. Pruning:

1. Broken or badly bruised branches shall be removed with a clean cut. Each plant shall be pruned to preserve its natural character and in a manner appropriate to its particular requirements. In general, at least 1/3 of the wood of deciduous plants shall be removed by thinning or shortening branches but no leaders shall be cut. All pruning shall be done with clean, sharp tools. The pruning of all plants shall be done on the job site, or as otherwise specified or approved by the Owner's Representative. All plants pruned without previous approval shall be rejected.

2. Deciduous trees and shrubs shall be pruned to reduce the vegetative growth by 1/3 of its total branching. Wood removed shall be inferior branches, competing branches, crossing branches, and dead and damaged wood. The natural branching habit of the plant shall be adhered to at all times.

3. Trees used in street/open area tree plantings shall have all branches removed up to a height of seven (7) feet.

4. The center leader of all major trees will be straight, healthy and unimpaired in any way. Damaged leaders will not be acceptable.

5. Balled plants (B.B., B&B): shall be backfilled with topsoil carefully tamped around and under the base of each ball to fill voids. Platforms shall be removed. All burlap, ropes, etc., shall be removed from the tops of all balls, but no burlap or wrapping shall be pulled out from under that ball.

6. Bare-Root Plants: Roots of bare-root (B.R.) plants shall be properly spread out in a natural position and topsoil shall be worked in amount them by watering. All broken and frayed roots shall be cleanly cut off.

7. Container-Grown Plants: Container-grown plants shall have been grown in pots, tubs or boxes for a minimum of six (6) months and a maximum of two (2) years. Plants shall have sufficient roots to hold the earth together, intact after removal from containers, without being rootbound. The sizes for containers shall conform to the largest size container specified in the "*American Standard for Nursery Stock*" by the *American Association of Nurserymen, Inc.*

H. Fertilizer and Superphosphate:

1. Fertilizer as described under Part 2 shall be placed just prior to mulching each plant.

2. The placing of superphosphate after tree or shrub planting will not be permitted. All planting will cease until superphosphate becomes available for use.

I. Water and Mulch:

1. A shallow saucer the entire size of the pit, capable of holding water, shall be formed about each plant as shown on the plans.

2. All shrub beds shall be completely covered with wood chip mulch.

3. At the time of planting, the soil around each plant shall be saturated with 25 gallons of water for each square yard of pit area. All trees and shrubs will be watered at least once per week, unless otherwise directed by the Architect until Final Acceptance.

J. Edging of Planting Areas: All edging materials shall conform to the requirements of Item 2.07 above. Edging shall be provided at all planting beds, unless indicated otherwise on the Contract Drawings. The Contractor shall establish a neat edge where planting areas meet grass areas as shown on the plan. Edging shall be done by competent mechanics in workmanlike manner with spade or edging tool immediately after all planting and seeding is completed. Particular care shall be exercised in edging to establish flowing maintainable curves. Edging shall be maintained by the Contractor for the duration of the contract.

K. Spraying With Anti-Desiccant: Immediately after planting and staking all plant material, the Contractor shall spray all plant material with an approved anti-desiccant, using an approved power sprayer to apply an adequate film over trunks, branches, twigs and/or foliage. The anti-desiccant shall be an emulsion which will provide a protective film over plant surfaces, permeable enough to permit transpiration. Anti-desiccants shall be used in strict accordance with manufacturer's instructions and shall be delivered to the site in manufacturer's sealed containers. The anti-desiccant shall be "*Wilt-Proof*" supplied by *Nursery Specialists Products, Inc*., Croton Falls, New York; "*Vanex*" supplied by *Vansul and Company*, 193 William Street, Englewood, New Jersey. Anti-desiccants shall be delivered in the containers of the manufacturer and shall be mixed according to the directions.

3.03 GENERAL

A. Access to All Operations for Inspection: The Contractor shall furnish such facilities and give such assistance for reasonable inspections as the Architect may request and shall secure free access to all sites where the plant material is located or work is in progress.

B. Restoration: All pavements, seeded or sodded and planted areas, structures and substructures not specifically provided for in the Contract, disturbed by the Contractor during the execution of the work, shall be restored by the Contractor, in a manner satisfactory to the Architect to their original conditions at no additional cost to the Owner.

3.04 GUARANTEE AND MAINTENANCE

A. As a part of the Contract, the Contractor shall guarantee the life of all plants in this contract for a period of one year after final acceptance of planting as specified in the following:

B. Any plant which is damaged destroyed or dies from whatever cause except theft or vandalism during the above period shall be replaced within fifteen days upon written notice to the Contractor by the Architect.

C. It should be noted that due to planting seasons, the Contractor will be required to replace any dead plant within the two planting season, during the one year guarantee period which may entail replacing the same plant twice after final acceptance.

D. Upon Substantial Completion, the Owner will assume responsibility for maintenance of planted areas. The Contractor shall, however, make monthly visits to the site during the guarantee period to advise the Owner of proper maintenance procedures. No additional payment shall be made for visits. Price bid for work of this trade shall include costs of visits.

E. Failure of the Contractor to notify the Architect, in writing, of inadequate maintenance by the Owner of the planted areas installed under this Contract shall constitute acceptance of the Owner's maintenance operations by the Contractor. The Contractor shall not, therefore, use the Owner's alleged lack of proper maintenance as a basis for voiding his responsibilities under the guarantee herein specified.

F. At the end of the one-year guarantee, the Contractor shall remove and dispose of all stakes, burlap and twine from all trees as approved by the Architect. Also, all holes left due to removal of stakes shall be filled with topsoil to the existing grade.

G. The cost of maintenance, replanting operations and removal of staking and wrapping shall be included in the Contractor's bid price.

3.05 FINAL INSPECTION OF LANDSCAPING WORK

A. When, in the opinion of the Contractor, the work is complete and ready for final inspection, he shall notify the Architect who will arrange to give the entire work a thorough inspection. Before final payment will be made, any dead plants, defects or omissions noted on this inspection must be rectified by the Contractor without additional compensation.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 329301 – PLANT MAINTENANCE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Maintain plants in manner that promotes health, growth, color and appearance, to quality levels specified; replace dead, dying, and damaged plants at no extra cost to the Owner.

   1. Perform soil analysis to determine type and quantity of soil amendments; test enough soil samples to obtain a comprehensive analysis; submit reports.

B. Maintain newly planted landscape plants, including turf (lawns), trees, and shrubs.

C. Clean up landscaped areas.

D. Start Date: Project Date of Substantial Completion.

E. Maintenance Period: The time frame covered by these requirements is 90 days from substantial completion.

1.02 RELATED SECTIONS

A. Section 328000 – Irrigation System
B. Section 329000 – Turf and Grasses
C. Section 329300 – Plants

1.03 QUALITY ASSURANCE

A. Qualifications: Company specializing in maintaining plant materials, with at least three years documented experience.

1.04 SUBMITTALS FOR REVIEW

A. Submittals shall be in accordance with Section 013300.

B. Submit complete maintenance plan, showing:

   1. Irrigation volume and frequency.

   2. Fertilizer type, quantity, and schedule of application.

   3. Soil amendment type, quantity, and schedule of application.

   4. Personnel assigned, including supervisor.

   5. Inspection procedures, diagnostics, and remedies.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 INSTALLATION

A. If soil analysis has not already been performed, take sufficient samples to obtain a comprehensive analysis; perform analysis in accordance with ASTM D 4972. Saturate soil with water to test drainage.

3.02 LANDSCAPE MAINTENANCE – GENERAL

A. Protect existing vegetation, pavements, and facilities from damage due to maintenance activities; restore damaged items to original condition or replace, at no extra cost to the Owner.

B. General Cleanup: Remove debris from all landscape areas at least once a week and from turf areas before each mowing.

1. Debris consists of trash, rubbish, dropped leaves, downed branches and limbs of all sizes, dead vegetation, rocks, and other material not belonging in landscaped areas.

2. Remove debris from site and dispose of properly.

C. Watering, Soil Erosion, and Sedimentation Control: Comply with federal, state, local, and other regulations in force; prevent over-watering, run-off, erosion, puddling, and ponding.

1. Repair temporary erosion control mechanisms provided by others.

2. Repair eroded areas and replant, when caused by inadequate maintenance.

3. Prevent sediment from entering storm drains.

D. Trees: Exercise care to avoid girdling trees; provide protective collars if necessary; remove protective collars at end of maintenance period.

E. Fertilizing: Apply fertilizer only when necessary.

F. Drainage Channels: Remove obstructions in gutters, catch basins, storm drain inlets, yard drains, swales, ditches, and overflows.

1. Remove grates from catch basins to clean.

2. Prevent encroachment of other vegetation on turfed surface drainage channels.

G. Health Maintenance: Inspect all plants regularly for health:

1. Eradicate diseases and damaging pests, regardless of severity or speed of effect.

2. Treat accidental injuries and abrasions.

3. If a plant is unhealthy but not yet dead, according to specified definitions, determine reason(s) and take remedial action immediately.

4. Remove dead plants immediately upon determining that they are dead.

H. Pesticide and Herbicide Application: Not Permitted on School property.

I. Replanting: Perform replacement and replanting immediately upon removal of dead plant.

3.03 IRRIGATION

A. Irrigation: Do not allow plants to wilt; apply water as required to supplement rainfall; do not waste water; do not water plants or areas not needing water; do not water during rainfall; shut off water flow when finished; repair leaks.

B. Provide backflow preventers on hose bibbs used for irrigation hoses.

3.04 TURF MAINTENANCE

A. Maintain turf in manner required to produce turf that is healthy, uniform in color and leaf texture, and free from weeds and other undesirable growth.

1. Grass Density - Lawns: 20 plants per square foot, minimum.

2. Bare Spots - Lawns: 2 percent of total area, maximum; 6 inches square, maximum.

3. Keep turf relatively free of thatch, woody plant roots, diseases, nematodes, soil-borne insects, stones larger than 1 inch in diameter, and other materials detrimental to grass growth.

4. Limit broadleaf weeds and patches of foreign grass to a maximum of 2 percent of the total area.

B. Mowing: During growing season(s) mow turf to uniform height, in manner that prevents scalping, rutting, bruising, and uneven or rough cutting.

1. Prior to mowing clean all debris and leaves from turf surface.

2. Schedule frequency of mowing so that no more than one-quarter to one-third of grass leaf length is removed during a cutting.

3. Make each successive mowing at approximately 45 degrees to the previous mowing, if practical.

4. Cool Season Grasses:

a. Reduce mowing height in fall and spring.
b. Use rotary type mowers; mulcher type mowers may be used.

5. Warm Season Grasses:

a. Increase mowing height slightly as fall approaches.
b. Use reel type mowers; do not use mulcher mowers.

C. Summer Mowing Height for Lawns: 3 inches in height.

D. Trimming: Immediately after each mowing, neatly trim perimeter of each turf area and around obstructions within turf area; match height and appearance of adjacent turf.

1. Adjacent to Pavements: Cut edges of turf to form a distinct, uniform turf edge.

2. Adjacent to Planting Beds and Permanently Mulched Areas: Cut edges of turf to form a distinct, uniform turf edge.

3. Around Other Trees and Poles: Where no planting bed or mulched area exists, trimming with string trimmer is acceptable.

4. At Fences: Trim on both sides of fence.

5. Irrigation Heads and Valve Boxes: Trim neatly so grass doesn't interfere with operation.

E. Fertilizer: Apply as recommended by manufacturer and at rate indicated by soil analysis.

1. Cool Season Grasses: Apply at least once, in Fall before first frost; do not apply high nitrogen fertilizer during Summer; Spring application is optional but must be reduced in quantity.

F. Ground Covers:

1. Trim to encourage dense, well-developed growth covering intended areas.

2. Do not allow plants to grow up trees, shrubs, or vines or encroach into turf or drainage channels, unless the drainage channel is intended to be planted with ground cover.

3. Remove existing plants grown up trees, shrubs, and vines.

G. Flowering Plants: Remove dead flower heads; do not trim off leaves of flowering bulbs until they are brown.

3.05 TREE AND SHRUB MAINTENANCE

A. Trees will be considered dead when main leader has died back or when 25 percent or more of crown has died; except as otherwise indicated for palm trees.

B. Shrubs will be considered dead when 25 percent or more of plant has died.

C. Inspect woody plants for health by scraping up to 1/16 inch square area of bark; no green cambium layer below bark shall be evidence of death.

D. Adjust stakes, guys and turnbuckles, ties, and trunk wrap as required to promote growth and avoid girdling.

E. Pruning: Unless otherwise indicated, prune only to maintain balanced natural shape; follow recommendations of ANSI A300 and ANSI Z133.1 and best local practices for species involved.

F. Shrubs: Prune at least once during maintenance period at best time to influence ultimate shape and size for the particular species.

1. Prune to balance the plant's form and according to its natural growth characteristics.

2. Remove water shoots, suckers, and branches not conforming to desired shape and size.

G. Young Trees: Prune at least once during maintenance period at best time to influence ultimate shape and size for the particular species; do not remove or cut off leader.

3.06 CLEANING

A. Remove fallen deciduous leaves in Fall; removal may wait until all leaves have fallen.

B. Clean adjacent pavements of plant debris and other debris generated by maintenance activities.

C. Remove and dispose of general cleanup debris and biodegradable debris in a proper manner.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 333000 – SANITARY SEWERAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish labor, materials, services, equipment, and other necessary items required for accomplishing the construction of the on-site sanitary drainage systems. This shall include, but not be limited to, the following:

1. On-site sanitary disposal systems, including all I/A Systems, septic tanks, grease traps, leaching pools, castings, covers, system piping and other sanitary components where indicated on the drawings.

2. Related items necessary to perform work, including all required coordination and interface between installing contractor and local Health Department, including but not limited to: permitting procedures, scheduling of required Health Department tests, inspections and closeout.

B. All sanitary Approvals to Construct shall be obtained and provided by the Architect/Engineer. Contractor shall perform all work necessary to install the proposed sanitary systems and related components in accordance with the proposed design as shown on the drawings. The contractor shall only utilize components and materials currently approved by the local Health Department or other agency having jurisdiction over the required installations. All items to be installed in strict accordance with the methods approved by the local Health Department.

C. Set lines, elevations, and grades for utility and drainage system work and control system for duration of work, including careful maintenance of benchmarks, property corners, monuments, or other reference points.

D. If this is a LEED Certified project, the work must comply with the requirements of the following related specifications sections:

1. **Division 01 Section 013563 "LEED Requirements" for recycled content and regional materials requirements, submittals, and additional LEED requirements.**

2. **Division 01 Section 017419 "Construction Waste Management" for recycling construction waste.**

E. Should actual field conditions differ from those shown on the Contract Documents, the Architect shall be immediately notified and no further operations will commence until further notice.

F. No changes are authorized without the Architect's and jurisdictional Health Department's written approval.

G. The Contractor shall be familiar with local Health Department rules and regulations and shall be responsible to arrange and coordinate any required inspections, create and submit as-builts drawings and any other documents necessary to obtain final approvals of constructed work.

1.02 RELATED REQUIREMENTS

A. Construction drawings.

B. Specification Sections:

1. Section 310000 – Earthwork
2. Section 321216 – Asphalt Paving
3. Section 329000 – Turf and Grasses
4. Section 331000 – Water Systems
5. Section 332400 – Storm Water Drainage, Structures and Castings
6. Section 334000.12 – Abandonment of Existing Sanitary and Stormwater Systems

C. Local Department of Health Services regulations.

D. Local governing authority and code requirements.

E. All necessary construction permits.

1.03 REFERENCE STANDARDS

A. All applicable ASTM Specifications, NYSDOT and ASSHTO standards.

B. Nassau County Department of Health Standards, if applicable.

C. Nassau County Department of Public Works, if applicable

1.04 SUBMITTALS

A. Submit manufacturer's product data and written specifications for all components: precast structures, cast iron frames and covers, pipe, valves, fittings, filter fabric, etc. in accordance with Section 013300.

1. Submit shop drawings to the Architect for approval of the following items:
2. Precast concrete sanitary system structures, grease traps, septic systems and leaching pools.
3. Perforated and non-perforated corrugated polyethylene pipe and fittings (for stormwater drainage systems).
4. Cast iron frames and covers.
5. Sanitary drainage piping.
6. Filter fabric.

B. Submittals shall include ASTM designations, AWWA certifications, and UL labels as required.

C. Obtain approval from the Architect before materials are ordered from the manufacturer.

D. **LEED Submittals: Submit recycled content and regional materials documentation for each type of product provided under work of this Section in accordance with Section 013563 "LEED Requirements".**

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in ample time to facilitate the work as under this Section.

B. Store and handle all materials in accordance with the manufacturer's recommendations.

1.06 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to potable water and sanitary sewage systems.

B. Unless otherwise instructed, all work is to be observed by the Architect/Engineer, and tests and observation work are to meet his approval at each stage prior to backfilling. ***When public authorities require observation and approval by, or supervision of, the Work is required, comply with their requirements. Re-excavate any Work covered before observation and approval by local jurisdictional agencies at no additional cost to the Owner.***

C. Install pipe and fittings in strict accordance with best acceptable practice to insure proper functioning, freedom from trouble, and neatness of appearance.

D. Provide proper fittings for the installation of, and connection to sewer lines. Where an underground branch connection is required, provide a "Y" branch and 30-degree curve-type fitting. Connections made by cutting holes in pipe will not be permitted.

E. Prior to final observation, flush sewers with water in sufficient volume to obtain free flow through each line. Remove all obstructions and correct defects discovered.

F. Verify all connection requirements with the utility owner(s).

PART 2 - MATERIALS

2.01 CONSTRUCTION MATERIALS REQUIREMENTS

A. General – All components used in the sewage disposal system shall comply with the N.Y.S.P.C and with the appropriate National Sanitation Foundation (NSF), the American Society of Testing Materials (ASTM), the American Association of Highway and Traffic Office, and/or the American Water Works Association (AWWA) requirements. Concrete used in the construction of sewage disposal system components shall conform to ASTM C-33 and ASTM C-150 standards. Concrete reinforcement shall conform to ASTM A-185 and ASTM A-615 as applicable. All materials shall be identified as to manufacturer and have identification visible at the time of inspection.

2.02 SANITARY DISPOSAL SYSTEM

A. All septic tank components (i.e. – slabs, domes, covers, etc.) shall be constructed of precast reinforced concrete and designed to be traffic bearing to meet the requirements of AASHTO H-20 loading.

B. Grease Traps: All restaurants and/or food preparation establishments are required to install a grease trap for the kitchen or food preparation area. A grease trap is considered part of the equipment necessary to obtain a Permit to Operate a Food Establishment pursuant to the Local County Sanitary Code. Grease traps must be cleaned and maintained on a regular basis in order to insure proper functioning ad insect-free performance. Grease traps shall be located below grade and outside the building preceding the septic tank or sewer line. Only discharges from the kitchen or food preparation areas may be piped to grease traps. Grease traps shall be located in areas that are easily accessible for routine inspection and maintenance. Internal grease traps are permitted when allowed by the Health Department.

1. All external grease trap components (i.e. – slabs, domes, covers, etc.) shall be constructed of precast reinforced concrete and designed to be traffic bearing to meet the requirements of AASHTO H-20 loading.

2. All internal grease traps shall be placed on kitchen waste branch pipes prior to connecting to the main sanitary sewer line.

C. Leaching Pools: Leaching pools must be installed in areas that are easily accessible for routine inspection, maintenance, replacement or expansion. Refer to Local Health Department guidelines

for additional requirements concerning the location of leaching pools.

1. The maximum permissible depth of a precast concrete leaching pool is twenty-five feet from finished grade. The minimum permissible effective depth of any leaching pool shall be three feet.

2. The minimum vertical separation distance from the bottom of the leaching pools to the highest recorded groundwater elevation shall be 3 feet for all new leaching pools installed.

3. All leaching pools (i.e.–slabs, domes, covers, etc.) shall be constructed of precast reinforced concrete and designed to be traffic bearing to meet the requirements of AASHTO H-20 loading.

D. Manholes: Manholes are used as a part of a sewage disposal and collection systems to distribute equal volumes of sewage, to allow for access, or to collect and re-distribute sewage.

1. All manholes (i.e.–slabs, covers, etc.) shall be constructed of precast reinforced concrete and designed to be traffic bearing to meet the requirements of AASHTO H-20 loading.

E. Gravity Sewer Lines: Gravity sewer lines and fittings shall meet or exceed ASTM Standard D-3034 for PVC sewer pipe with a minimum SDR 35 rating, unless otherwise indicated.

1. PVC pipe and fittings shall be provided with integral bells and spigots and rubber sealing tings. The sealing rings shall meet the requirements of ASTM Standard F-4&7. All sewer lines shall be straight, and couplings shall be securely installed and be watertight.

2. All sewer lines shall have a minimum diameter of four (4) inches.

F. House Connections: A house connection is defined as the portion of the gravity sewer line which extends from the face of the building to the sewage disposal or sewer system.

1. There shall be a minimum two (2) foot length of cast iron sewer line extending through the foundation.

2. House connections shall have a minimum diameter of 4 inches, unless otherwise noted; house connections serving two or more commercial or multiple residential units shall have a minimum diameter of 6 inches.

3. House connections shall have a minimum pitch of one-quarter inch per foot.

4. Slip ring connectors of the proper type shall be used at the cast iron joint. If required, a flexible PVC coupling with stainless steel bands may be used to connect cast iron pipe to PVC house connections. The flexible coupling and bands shall conform to ASTM C1173.

5. All house connections shall be provided with a clean-out at the face of the building.

G. Castings and covers shall be extra heavy cast iron and steel of the type specified on the contract drawings, conforming to the requirements of the municipality having jurisdiction.

H. Polyvinyl Chloride Sanitary Sewer Pipe (unless otherwise noted on approved construction plans):

1. Pipe and fittings shall comply with ASTM D 3034-78 or D949-86, and shall have a pipe diameter to wall thickness ratio (SDR) of 35 minimum. Pipe shall be ASTM Type PSM, continually marked with manufacturer's name, pipe size, cell classifications, SDR rating, and ASTM D3034 classification.

2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied

elastomeric gaskets and lubricant.

3. Furnish factory-fabricated pipe fittings of the highest quality and of he same type and class of material as the pipe.

4. At the main sanitary pipe transition between the plumber and site contractor, use non-shear high strength PVC elastomeric couplings when jointing non-similar materials.

I. Ductile Iron Sanitary Sewer Pipe (DIP) and Fittings:

1. Ductile iron pipe shall be centrifugally cast, conforming to the requirements of ANSI, A21.51 (AWWA C151).

2. Pipe and fittings shall be Pressure Class 150 psi and shall have a minimum wall thickness of Class 53 pipe.

3. Fittings shall be cast iron or ductile iron conforming to the requirements of ANSI A21.10 (AWWA C110).

4. All pipe joints shall be either mechanical joints or push-on joints. Joints for valves and fittings may be flanged. Mechanical joints, push-on joints and gaskets shall conform to the requirements of ANSI A21.11 (AWWA C111).

5. All gaskets for mechanical joints shall be lead-tipped gaskets.

6. Flanged joints shall conform to the requirements of ANSI A21.15 (AWWA C115) and ANSI B16.1.

7. Lining: All pipe and fittings shall be cement lined in accordance with ANSI A21.4 (AWWA C104). The lining shall be centrifugally applied and have a bituminous sealer. The cement lining shall be standard thickness.

8. All pipe and fittings shall be coated on the outside at the point of manufacture with a coal tar pitch varnish (Pipe dip). The coating shall average one-and-one-half (1½) to two (2) mil dry film thickness.

9. Pipe and fittings shall be encased in polyethylene tubes or sheets in accordance with ANSI A21.5 (AWWA C105). The polyethylene tubes shall have a minimum thickness of eight (8) mil.

J. Cleanouts, including those in vitrified clay lines, shall be iron body type with extra heavy bronze plugs.

K. Manholes:

1. Construct manholes of precast concrete sections as required by the drawings to size, shape, and depth indicated, but never less than 2'-0" inside diameter.

2. Precast Construction (septic tanks, leaching pools, grease traps, pool wrap, backfill material, grouts, castings, etc.): Construction shall comply with the requirements of the Local County Department of Health Services, and shall be of the type specified on the Contract Drawings.

3. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls and point up irregularities and rough edges with non-shrinking grout.

4. Inverts: Shape inverts for smooth flow across structure floor as shown on the drawings. Use

concrete and mortar to obtain proper grade and contour and finish surface with fine textured wood float.

5. Cast Iron Frames, Covers, and Grates: After completion of manhole or inlet, set frame in full mortar bed and adjust to required elevation.

L. In all instances, use only new materials.

PART 3 - EXECUTION

3.01 INSTALLATION – SANITARY SYSTEM & PIPING

A. All installations shall be in accordance with plans as approved by the Local Health Department.

B. Provide all necessary excavation, trenching, shoring, and backfilling required for the installation of all septic tanks and leaching structures and for the proper laying of all pipe. Do not backfill until installation has been inspected by the Local Health Department and approved. Install system components and pipe promptly after excavation, schedule with inspecting agency on-site to approve, to keep the excavation open for as short a time as possible.

C. Sewage disposal systems shall not be located:

1. In any area subject to imminent erosion, which cannot be controlled so as to protect the sewage disposal system(s);

2. In areas where the highest recorded groundwater level is less than one foot below the original ground surface;

3. In areas with existing slopes greater than 15%, unless the site can be properly graded in accordance with the standards of the Local Health Department.

4. In areas where the existing subsoils contain meadow mat, bog, silts, clays or other impervious material extending below the groundwater table;

5. In areas where the groundwater conditions are not conducive to the proper functioning of subsurface sewage disposal systems;

6. Where topography concentrates runoff onto or into the area where the system is proposed;

7. In any area or under any part of a building, or other improvements that does or may prevent reasonable access for repair or maintenance of the system;

8. In any area which may reasonably be expected to create a public health risk.

D. Site Condition Requirements: Sewage disposal systems shall be located:

1. On land owned in fee by the applicant (except for Community or Municipal Sewage Treatment Systems);

2. On the same parcel as the building(s) to be serviced (except for Community or Municipal Sewage Treatment Systems);

3. In an area which is easily accessible for purposes of maintenance and/or replacement of sewage disposal and treatment system components;

4. In accordance with the minimum separation distances and other conditions dictated by the Local Health Department.

E. Other Site Specific Considerations: To protect the public water supply and the benefits that freshwater wetlands, tidal wetlands, streams, and other surface waters provide, all projects may be subject to a separate site review by the Local Health Department. The following criteria may apply to these sites:

1. Sewage disposal systems shall be located to maximize distances to public water supply wells. If the Local Health Department determines that insufficient distance exists to protect the well, further treatment may be required.

2. Sewage disposal systems shall be located to maximize distances to regulated freshwater wetlands, tidal wetlands, ponds, streams, and other surface waters. The Contractor shall refer to the Local Health Department standards for specific separation distance requirements.

F. House Connections: All house connections shall be straight; there shall be no bends in sewer lines to the septic tank or grease trap. If bends are unavoidable, then the following additional criteria shall apply:

1. For bends greater than 10 feet from the building foundation as measured along the length of the sewer pipe, an approved manhole will be required where the pipe changes direction.

2. For bends within 10 feet of the building foundation measured along the length of the sewer pipe, no fittings greater than 45 degrees shall be installed. If a directional change greater than 45 degrees is required, a minimum of five foot length of pipe shall be installed between fittings. The maximum permitted change in alignment of the sewer line shall be 90 degrees as measured along the axis of the starting pipe.

3. Cleanouts are required at any bend within 10 feet from the building or every 75 feet along the length of the house connection.

G. Sewer Main / Lateral Sewer Requirements: Sewer main and lateral sewers shall have a uniform slope and be laid with a straight alignment, without bends. When required, approved manholes may be utilized where sewers change direction or slope. House or building sewers shall be connected to main or lateral sewers with approved wye fittings. Sewers shall be provided with manholes at intervals not to exceed 400 feet. Sewer main and lateral sewers shall have a minimum diameter of eight inches, and shall have a minimum slope of 0.4%. Ten inch diameter sewers shall have a minimum slope of 0.28%. Sewer main and lateral sewers that have less than 2 foot of cover or are not placed on virgin soil shall be constructed of ductile iron pipe. Sewer main and lateral sewers that have between 2 foot and 4 foot of cover shall be constructed of DR18 or ductile iron pipe. Sewer main and lateral sewers that have over 4 foot of cover may utilize SDR35 pipe.

H. Installation and Backfilling of Sewer Mains/ Lateral Sewers:

1. The width of trenches shall be adequate to allow sewer pipe to be laid and joined properly and to allow bedding and haunching to be placed and compacted to adequately support the pipe.

2. The embedment material around the PVC pipe shall be installed in layers not exceeding six inches. The embedment material shall be Class I, Class II, or Class III. Class I material shall conform to the following standards: minimum particle size ¾ inches, not less than 50% weight of material shall pass the 3/8 inch sieve. Class II material is defined as coarse sands and gravels with maximum particle size of 40 mm (1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Unified Soil Classification Types GW, CP, SW, SP are included in this Class. Class III material is defined as fine sand and clayey gravels, including fine sands, sand-clay mixtures,

and gravel-clay mixtures. All backfill material within one foot horizontally and one foot above the crown of the pipe shall be placed by hand and requires hand compaction.

3. Each layer of Class II and Class III material shall be compacted to a minimum density of ninety-five (95) percent of maximum density of the soil as determined by the Standard Proctor Test AASHTO Designation T-99.

4. For additional requirements concerning the installation of PVC sewer pipe, refer to ASTM Standard D-2321, *"Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications"*.

5. Testing – Deflection testing of every section of sewer main or lateral sewers, constructed of PVC, is required by the Local Health Department. The total vertical wall deflection of the PVC pipe, as determined by testing not earlier than 30 days after placement and compaction of the final backfill, shall not exceed four (4) percent of the inside pipe diameter. The deflection shall be checked by manually pulling a "GO – NO GO" deflection testing mandrell through the pipe. The Contractor shall conduct the tests under the observation of the certifying Engineer/Architect.

I. Separation of Sewer and Water Lines:

1. Parallel Installation: Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main or lateral. The distance shall be measured edge to edge.

2. If it is not practical to maintain a horizontal separation of ten feet, the Local Health Department may allow a deviation on a case-by-case basis. Such deviation may allow for the installation of the sewer to be a minimum of 5 feet to a water main or a lateral, provided that the bottom of the water main or lateral is at least 18 inches above the top of the sewer line.

J. Separation of Sewer and Drainage Lines:

1. Sewers shall be laid at least 5 feet horizontally from any existing or proposed drainage line. The distance shall be measured edge to edge.

2. In the event that the drainage pipe must cross over the sewer line, the sewer line must be constructed of ductile iron pipe, unless a separation distance of 18 or more inches is maintained.

3. In the event that the sewer line must cross over the drainage line, the sewer line shall be constructed of ductile iron pipe for a distance of 3 feet horizontally into virgin soil.

4. If perimeter roof drainage piping is installed near the face of the building, all house connections must be constructed of ductile iron pipe for 10 feet from the building.

K. Construct pipe lines of full length sections of pipe specified. Install horizontal pipe to a uniform grade.

L. Keep inside of pipe clean at all times.

M. Make joints between ductile-iron pipe and other types of pipe with standard manufactured ductile-iron adapters and fittings.

N. Asbestos cement pipe and fittings not permitted.

O. Site Contractor shall be responsible for the installation of all components beyond five (5) feet from building perimeter (or existing outfall line). All piping inward from this point shall be the responsibility

of the Plumbing Contractor. Do not lay any sanitary lines closer horizontally than 10 feet to a water main or service line. Where sanitary lines pass above waterlines, encase such lines in concrete for a distance of 10 feet on each side of the crossing or substitute rubber gasketed pressure pipe for the pipe being used for the same distance. Where sanitary lines pass below water lines, lay pipe so that no joint in the line will be closer than 3 feet horizontally to the water line.

P. Site and Plumbing Contractors shall coordinate their operations to ensure a smooth transition between each other's work.

Q. Site Contractor shall be responsible for maintaining the minimum separations between sanitary system components and other subsurface utilities and structures. ***Any and all crossings shall maintain minimum separations/methods as prescribed by the local health department or other agency having jurisdiction.***

R. Septic Tank Requirements – All conventional subsurface and/or alternative sewage disposal systems shall contain a septic tank as a part of the overall sanitary disposal system design. Septic tanks shall be located below grade and outside the building in either paved or unpaved areas. Septic tanks shall be located in areas that are easily accessible for routine inspection and maintenance. Refer to Local Health Department requirements for additional siting requirements.

1. Septic tanks shall be designed to hold two day's Design Sewage Flow, with a minimum capacity of 1,200 gallons. The Design Sewage Flow for the project must be calculated from the design standards of the Local Health Department.

    a. All single unit septic tanks shall be cylindrical in shape, and shall meet the following requirements:

        1) Minimum outside diameter cylindrical septic tank shall be 8 feet and the maximum outside diameter shall be 12 feet.

        2) Minimum liquid depth of any cylindrical septic tank shall be 4 feet. Liquid depth is the effective depth of the tank below the outlet pipe.

        3) Eight (8) foot diameter tanks shall have a maximum liquid depth of 5 feet.

        4) Ten (10) foot diameter tanks shall have a maximum liquid depth of 6 feet.

        5) Twelve (12) foot diameter tanks shall have a maximum liquid depth of 7 feet.

        6) There shall be a maximum number of three (3) outlet pipes from the septic tank. All outlet pipes shall be set at the same elevation.

    b. All two-unit septic tanks shall meet the above single unit requirements, plus:

        1) Units shall be connected with three (3)-8 inch diameter pipes placed such that the center lines of the pipes are 18 inches below the liquid level of the tank. The three connecting pipes shall be spaced 20 inches on centers. Each unit shall the same diameter and liquid depth.

    c. All multiple-unit septic tanks shall meet the above single unit requirements. Multiple unit septic tanks shall require the following:

        1) When three or more individual septic tanks are utilized within one system, they shall be placed on a common reinforced concrete slab at least 6 inches thick.

        2) All units shall be connected with two (2)-8 inch diameter pipes placed such that the

center lines of the pipes are 18 inches below the liquid level of the tank. Each connecting pipe set shall be spaced 20 inches on centers.

3) Each unit shall have the same diameter and liquid depth.

3.02 FIELD QUALITY CONTROL

A. Water Supply Systems: Test water distribution system pipe sizes installed below grade and outside building in accordance with PCNYS Section 312 requirements and the following procedures:
   1. All pipe work shall be tested at the pressure and leakage tests equal to the design working pressure of the pipe (150 psi) and maintain said pressure for not less than two hours.

   2. Furnish, install, and operate the necessary connections, pump, meter, and gauges. Leakage shall not exceed that permitted by AWWA Specification C600-64 for mechanical joint and push-on joint pipe. Prior to running any field test, meter shall be tested, sealed, and approved by applicable governing authority at the Contractor's expense.

   3. Locate and repair all leaks and repeat tests until test results are satisfactory and in compliance with this section.

   4. Furnish copy of results of meter test and hydrostatic pressure test to Owner upon completion of water distribution backfilling operations.

B. Sanitary Sewer Systems: Test sanitary sewer system to meet all requirements of the local governing authority. Perform all other required testing and inspections in accordance with the local Health Department or other agency having jurisdiction.

3.03 INSPECTION / BACKFILLING

A. All sequential inspections shall be conducted by the Local Health Department, coordinated by and through the Contractor. The inspector shall review all piping and section alignment, infiltration, or other defects in the installation, and the Contractor shall correct accordingly. The Contractor shall expeditiously conduct all required revisions to the satisfaction of the Health Department officials assigned to the project. The Contractor shall obtain all final written clearances from the Health Department inspectors allowing the systems to be backfilled, and shall provide copies of same to the Architect for his distribution to the Owner for future use and files.

B. The completed system shall be backfilled and covered with suitable soil following permission to do so by the Local Health Department. The property shall be graded to minimize surface drainage into the system. A maximum 5 percent slope downward shall be maintained for 20 feet horizontally from the nearest edge of the leaching portion of the pool(s) to the toe of the slope before tapering off to prevent seepage of the leachate through the slope. Dummy rings that are utilized to bring the system to grade shall be permitted to be placed at a lesser horizontal distance. Steep grades further than twenty feet from leaching pools shall be stabilized pursuant to local codes.

3.04 SITE RESTORATION AND CLEAN-UP

A. The Contractor shall clean up and legally remove from the site all rubbish and surplus material as it accumulates and shall not permit it to be scattered around the project site.

B. If this is a LEED Certified Project, disposal must comply with Division 01 Section 017419 “Construction Waste Management” for recycling construction waste.

C. The Contractor shall restore all areas of the site affected by the work to its original condition, inclusive of pavements, topsoil and grass, plantings or other ground cover.

3.05 GUARANTEE

A. Provide guarantee, stating that the work will remain free of defects in materials and workmanship for a minimum period of 10 years from the date of Substantial Completion and that upon failure of the installation to perform as warranted, the Contractor will repair or replace the defective work to conform with the requirements of the Contract Documents, including removal and replacement of other work as required.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 334000 – STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this section is subject to all applicable provisions of the "General Conditions" and "Supplementary General Conditions", which form a part hereof whether attached hereto or not.

B. Work Included: Furnish labor, materials, equipment, and appurtenances required to perform all work including, but not limited to, the following:

1. Provision and installation of precast catch basins, leaching basins, and other drainage structures where indicated on the drawings.

2. Provision and installation of drainage piping.

1.02 REFERENCE STANDARDS

A. All applicable ASTM Specifications, NYSDOT and AASHTO standards, latest editions, shall apply.

1.03 RELATED SECTIONS

A. Section 310000 – Earthwork
B. Section 310001 – Site Work General Provisions
C. Section 312500 – Sediment and Erosion Control Procedures and Requirements
D. Storm Water Pollution Prevention Plan, if applicable.
E. If this is a LEED project, the work must comply with the requirements of the following related specifications sections:

1. Section 013563 “LEED Requirements” for additional LEED requirements.
2. Section 017419 “Construction Waste Management” for recycling construction waste.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in ample time to facilitate the work as under this section.

B. Store and handle materials in accordance with manufacturer’s recommendations.

1.05 SUBMITTALS FOR REVIEW

A. Submittals shall be in accordance with Section 013300.

B. Product Data: Submit manufacturer's specifications and product data for all materials specified herein. Obtain approval from the Architect before materials are ordered from the manufacturer.

C. Shop Drawings: Submit shop drawings or distributor's information to the Architect for approval of the following:

1. Precast concrete drainage structures and pre-formed plastic drain inlets.

2. Perforated and non-perforated corrugated polyethylene pipe and fittings.

3. Cast iron frames & grates/covers and combination curb box inlets.

4. Filter fabric.

D. LEED Submittals (if applicable): Submit recycled content and regional materials documentation for each type of product provided under work of this section in accordance with section 013563 – LEED Requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND DISTRIBUTORS

A. Precast concrete structures and products shall be as manufactured by AFCO Precast Corp., Coastal Pipeline Corp., Pelkowski Precast, Corp. or approved equal.

B. Pre-formed plastic drain inlets and accessories shall be Nyloplast Drainage Structures as manufactured by Advanced Drainage Systems, Inc. (ADS), 1-800-821-6710, www.adspipe.com, or approved equal.

1. Polyvinyl Chloride (PVC) Catchbasin:

a. PVC Catchbasins shall be offered in size 8” – 36” with custom configurations as specified by engineer.
b. Diameters: The nominal diameters shall be in accordance with ASTM F679 and ASTM D3034.
c. Heights: Catchbasin body shall be manufactured and supplied in custom heights up to a total of 84 inches (7 ft). In the event that addition height is needed, a riser will be supplied by the manufacturer.
d. Catchbasins to be custom manufactured according to plan details. Risers are needed for basins over 84 in (7ft) due to shipping restrictions. All excess height shall be cut to proper elevation in field.
e. Drainage connection stub joint tightness shall confirm to ASTM D3212 for corrugated HDPE (ADS N-12/Hancor Dual Wall), Polypropylene (ADS N-12 HP Sanitite) & PVC.
f. Adapters shall be mounted in varies angles from 0 to 360 degrees, while allowing for minimum angle between adapters.
g. Castings shall be ductile iron per ASTM A536 Grade 70-50-05 and shall be furnished by the same manufacture as drain basin.
h. Concrete collars shall be installed in traffic loading situations according to manufacturer’s installation recommendations on details.
i. Weirs shall be custom built from gage 304 stainless steel when specified on plans

C. Corrugated polyethylene pipe (CPP) and fittings shall be "N-12" with smooth interior walls as manufactured by Advanced Drainage Systems, Inc. (ADS), 1-800-821-6710, www.adspipe.com, or approved equal.

D. Cast iron frames & grates/covers and combination curb box inlets shall be as manufactured by Campbell Foundry Co., Harrison, New Jersey; Neenah Foundry Co., Neenah, Wisconsin; or approved equal.

E. Filter fabric shall be synthetic and rot proof. Unless specifically noted otherwise on the plans, where used primarily for drainage such as wrapping of leaching rings, perforated underdrain piping, French drains, etc., provide:

1. Mirafi Series 140NC as manufactured by TenCate (www.mirafi.com)

2. Series FX-40HS as manufactured by Carthage Mills (www.carthagemills.com)

3. Series US-100NW as manufactured by US Fabrics, Inc. (www.usfabrics.com) or equal.

Fabric shall meet the following minimum requirements:

Property	ASTM Test Method	Value
Grab Tensile Strength	D4632	100 lbs.
Elongation	D4632	50%
Trapezoidal Tear Strength	D4533	45 lbs.
CBR Puncture Strength	D6241	250 lbs.
UV Resistance (at 500 hrs.)	D4355	70%
Apparent Opening Size (AOS)	D4751	70 US Sieve
Permittivity	D4491	2.00 $sec^{(-1)}$
Flow Rate	D4491	140 gpm/sf
Mass (Typical)	D5261	4.0 oz/sy
Thickness (Typical)	D5199	60 mils

F. All structures/products shall meet AASHTO H-20 loading unless otherwise specified on the drawings.

2.02 PRECAST CONCRETE PRODUCTS

A. Strength: 4,000 psi @ 28 days.

B. Cement: ASTM C-150.

C. Aggregates: ASTM C-33.

D. Water: Pure and potable.

E. Reinforcement: ASTM A-615.

F. Welded Wire Fabric: ASTM A-185.

2.03 CORRUGATED POLYETHYLENE PIPING (CPP)

A. Piping products shall meet the requirements of ASTM D-3350 and AASHTO M-252 or M-294, latest edition.

B. Pipe shall be provided with couplings, elbows, and other connections to maintain alignment and insure tight flexible joints. The materials shall be of the same composition as the pipe. Unless otherwise noted, provide soil-tight joints of either bell & spigot configuration or split-couplers.

C. Each length of pipe shall be marked with the manufacturer's trade name, class, type, size, and date of manufacture.

D. Diameter and size of piping shall be as indicated on the drawings.

2.04 CAST IRON FRAMES AND GRATES

A. All cast-iron frames & grates/covers, and combination curb box inlets shall meet the requirements for casting M6A – Steel Castings, Grade N-i; or M8 Iron Castings, Class No. 30; or M 13 – Malleable Iron Castings, Grade 32501 at the Contractor’s option.

B. Grates located in plazas, sidewalks, roadways at drop curbs, or other area of pedestrian activity,

shall be ADA compliant.

C. Round manhole frames & covers/grates shall be 22” diameter, unless otherwise noted or shown on the drawings.

D. Rectangular inlet frames & grates shall be 24”x36”, unless otherwise noted or shown on the drawings.

E. Frames, grates, and covers that are warped or rock in the opinion of the Architect will be rejected and removed from the site.

2.05 BRICK CHIMNEY

A. Comply with the ASTM Standard Specifications for Sewer Brick, designated C32-58, for Grade 5A, hard brick, except that the mean of five tests for absorption shall not exceed eight percent weight.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install shoring, sheet piling, or other acceptable excavation stabilization as required by OSHA or other agencies having jurisdiction, or as required by proximity to existing site features.

B. Sides of holes and trenches shall be near vertical as possible. Bracing or sheeting shall not be removed until the proper level of backfill has been reached.

C. Under no circumstances shall the materials of this section be laid in water.

D. Excavation shall be by open cut from the surface. Leaching holes shall be approximately 3'-0" wider than the outside diameter of section to be installed. Leaching rings and piping shall be set on undisturbed earth. Any and all excess excavation shall be backfilled and thoroughly compacted.

E. After the area to be occupied by each structure has been excavated of all deleterious and impervious materials and acceptable, clean sand and gravel has been encountered, set structures, wrap in filter fabric, and then backfill per item G.

F. All unused pipe knock outs in precast walls must be bricked or concreted to provide full wall thickness.

G. Backfill around drainage inlets and drywells shall be placed on all sides simultaneously and shall be unified soil classification type GW, GP SW or SP. Native soils not meeting this classification shall not be utilized for backfill unless specifically approved by the Architect. Additional backfilling beyond or above the 3’-0” collar shall be done with coarse sand, fine gravel, loam, clean earth, or other excavated materials, free from stones and foreign matter. Backfilling around catch basins and manholes shall be done in accordance with Section 0310000 – Earthwork. Drywell and leaching collar backfill shall be placed in lifts not to exceed 12” in depth. Once backfill has reached the top of the uppermost leachable ring of the structure, the entire leaching collar shall be filled (flooded) with water to settle the leaching collar backfill. A visual inspection shall be done by a certified testing lab with report. Repeat this process until all settlement has occurred and the backfill has reached the top of the uppermost leaching ring. Backfill shall then be placed from the top of the upper leaching ring to subgrade, in compacted lifts not to exceed 12”, and should be tested for compaction by a certified test lab with report. Compaction shall be at least 95% in paved areas and 85% in landscape areas, of the modified proctor test, ASTM D 1557.

H. Piping Installation:

1. Installation shall be in accordance with ASTM Recommended Practice D2321, or as shown on the drawings and specified herein. Refer to specification section 310000 – Earthwork for trenching and bedding material specifications.

2. Width of pipe trenches shall be kept to a minimum, while providing adequate space for workmen to place and joint the pipes properly. In no case shall the width of trench be more than 18 inches greater than the diameter of the pipe measured at bell. Trenching practice shall be in accordance with ASTM D2321 and AASHTO Section 30.

3. Install pipe true to designed line and grade, adjusting bedding as required.

4. For bell & spigot joints, install with bells facing upstream. Wood blocking should be utilized to prevent damage during seating of connections.

5. Backfill with approved material from bedding to 12 inches over the pipe in 6 inch layers, thoroughly compacting around the pipe with hand and/or mechanical tamping devices. Backfill evenly on each side of pipe to assure there is no shifting of alignment. From 12 inches over pipe to subgrade, backfill with excavated native material, but allow no trash, debris, or stones to be incorporated in backfill.

6. In all locations where pipes are under paved areas, backfill with approved material from bedding to subgrade in 6-inch layers, thoroughly compacting around the pipe with hand and/or mechanical tamping devices. Backfill evenly on each side of pipe to assure there is no shifting of alignment.

7. Openings in structures cut for piping shall be no larger than 4” greater than outside pipe dimension. Grout full thickness of drainage structure wall at piping.

8. Piping shall protrude from inside face of structure a minimum of 2” and a maximum of 8”.

I. Frames and grates shall be set so that the top of the frame will be flush with finished grade. Frames shall be set in a full bed of stiff mortar with a minimum of three (3) courses of brick and mortar.

J. After backfilling, provide sufficient stakes, flags, etc. to outline the drainage inlets, drywells, and/or piping to prevent disturbance by the use of trucks and heavy equipment.

K. All drainage structures and piping shall be protected and thoroughly cleaned at the completion of the project by the Contractor. Any defacements shall be corrected or replaced as directed by the Architect, without additional cost to the Owner.

L. All existing cast iron covers located within the area of new work shall be adjusted to finished grade.

3.02 SITE RESTORATION AND CLEAN UP

A. The Contractor shall clean up and legally remove from the sites all rubbish and surplus material as it accumulates and shall not permit it to be scattered around the project sites.

1. If this is a LEED project, disposal must comply with Division 01 Section 017419 “Construction Waste Management” for recycling construction waste.

B. The Contractor shall restore all areas of the site affected by the work to its original condition, inclusive of pavements, topsoil and grass, plantings or other ground cover.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 334000.11 – CLEANING EXISTING STORM WATER DRAINAGE SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Under this work, the Contractor shall clean existing catch basins, manholes, drop inlets, leaching basins, storm drains, and culverts as indicated on the plans and/or as directed by the Engineer.

1.02 CONSTRUCTION DETAILS

A. All drainage system components which lie within the construction area shall be cleaned of silt and debris in a workmanlike manner and maintained clean as determined by the Engineer for the duration of the contract. Material removed from the culverts shall be disposed of off the contract limits. The Contractor shall execute care for and protect all trees, fences, and drainage system components within, or adjacent to, the work site. The Contractor shall replace in kind any system components or other facilities damaged by his operation at his own expense.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 334010 – STORM WATER DRAINAGE RETENTION STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes stormwater drainage systems for building roof drainage and site area drainage.

B. Work includes the installation of the StormTech Chamber Drainage System, or an approved equivalent.

C. Related work includes the installation of drainage inlet structures, manholes and outlet structures.

1.02 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete
B. Section 310000 – Earthwork
C. Section 310001 – Site Work General Provisions
D. Section 312500 – Erosion and Sediment Controls
E. Section 334000 – Storm Drainage Utilities

1.03 ABBREVIATIONS

A. PP: Polypropylene
B. HDPE: High Density Polyethylene
C. PE: Polyethylene
D. PVC: Polyvinyl Chloride
E. ASTM – American Society for Testing and Materials
F. AASHTO – American Association of State Highway and Transportation Officials
G. ADS – Advanced Drainage Systems Inc.
H. TSS – Total Suspending Solids

1.04 DEFINITIONS

A. Stormwater Chamber System: All products associated with the drainage system including but not limited to chambers, end caps, pipe, fittings, stone, geotextile, and drainage structures.

B. Subsurface Drainage System: Refers to the StormTech subsurface stormwater chamber system.

C. Manifolds and manifold piping refer to the piping system to inlet and outlet rows of chambers.

D. STORMTECH brand name is referred to as CHAMBER MANUFACTURER hereafter.

E. ADS and HANCOR brand names are considered interchangeable within this section.

1.05 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO LRFD Bridge Design Specifications Section 3 – Loads and Load Factors
2. AASHTO LRFD Bridge Design Specifications Section 12 – Buried Structures and Tunnel Liners

3. AASHTO M 43 – Standard Specification for Sizes of Aggregate for Road and Bridge Construction
4. AASHTO M 288 – Standard Specification for Geotextile Specification for Highway Applications
5. AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter

B. American Society for Testing and Materials (ASTM)

1. ASTM F 2418 or F 2922 Standard Specification for Polypropylene (PP) or Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers
2. ASTM F 2787 Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers
3. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
4. ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings

1. A preinstallation meeting between StormTech representative and general contractor is recommended to discuss the chamber system installation.

    a. StormTech offers installation consultations to installing contractors.
    b. Contact StormTech at least 30 days prior to system installation to arrange a pre-installation consultation.

B. Sequencing

1. Contractor is responsible for coordinating the installation of the subsurface stormwater chamber system with the installation of permanent structures on site.

    a. Construction loads for permanent structures may require the subsurface chamber system to be installed after the permanent structure(s) on site.

2. Coordinate stormwater chamber system connections to off site storm sewer with the appropriate agency having jurisdiction.

3. Coordinate stormwater chamber system connections to existing on-site storm drain.

4. Coordinate with building roof drainage systems.

5. Coordinate with other utility work.

1.07 SUBMITTALS

A. The following shall be submitted by contractor in accordance with Submittal Procedures:

1. Product Specifications for the following:

    a. StormTech chambers and end caps
    b. ADS PE pipe

2. Product Installation Instructions for the following:

a. StormTech chambers and end caps
b. ADS PE pipe

3. Inspection and Maintenance Instructions for the following:

a. StormTech Isolator™ Row

1.08 QUALITY ASSURANCE

A. Regulatory Agency Approvals:

1. Environmental agency compliance: Comply with regulations pertaining to storm drainage systems.

2. Utility Compliance: Comply with regulations pertaining to storm drainage systems. Include standards of water and other utilities where appropriate.

B. Qualifications

1. Manufacturers

a. All chamber and end cap products must be produced in an ISO 9001 certified manufacturing facility or shall demonstrate at least 5 years of experience in the production of similar products.

1.09 DELIVERY, STORAGE AND HANDLING

A. Contractor shall check all materials upon delivery to assure that the proper chamber size and plastic pipe and pipe fittings have been received.

B. Contractor shall check the chambers for shipping damage prior to installation. Units that have been damaged must not be installed. Contractor shall contact chamber manufacturer immediately upon discovery of any damage. Chambers may be left palletized until the units are ready to be installed.

C. All chambers, pipe and pipe fittings shall be delivered to the site and unloaded with handling that conforms to the manufacturer's instructions for reasonable care.
D. Protect chamber and chamber fittings from dirt and damage.

E. All pipe and chambers shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of the pipe on the job shall be in accordance with the pipe manufacturer's recommendations.

F. Contractor shall refer to the fabric manufacturer's guidance handling and storage of fabric products on site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers

1. StormTech, Inc.

2. Or approved equivalent

2.02 STORMWATER CHAMBER SYSTEM

A. Chamber Options

1. Only stormwater chamber systems evaluated by a licensed design engineer and found to meet AASHTO section 12.12 safety factors are allowed.

2. Stormwater chambers must be designed in accordance with ASTM F 2418 or F 2922 Standard Specification for Polypropylene (PP) or Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers

3. Stormwater chambers must be designed in accordance with ASTM F 2787 Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers

4. Chamber systems allowed under this specification include:

   a. StormTech SC-160LP
   b. StormTech SC-310
   c. StormTech SC-740
   d. StormTech DC-780
   e. StormTech MC-3500

B. Performance

1. The contractor shall submit a structural evaluation by a registered structural engineer of the manufacturer that demonstrates that the safety factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 or F 2922 must be used as part of the AASHTO structural to verify long-term performance.

2. Only mechanical and material properties that were determined in accordance with ASTM test methods shall be allowed for structural design of the chambers.

3. Only chambers affixed with the ASTM F 2418 or F 2922 designation shall be considered as meeting ASTM F 2418 or F 2922.

4. Performance of the stormwater treatment system shall be in accordance with Section 2.03 of this specification.

5. The contractor shall submit design summary by the manufacturer that demonstrates that the system is designed to convey peak flow rates without scour of foundation stone.

C. Materials

1. Chamber

   a. Chambers shall be injection molded from virgin polypropylene or polyethylene resin and be yellow in color.

   b. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels in order to provide ease of access for inspection and maintenance functions.

   c. Inspection ports shall be installed and constructed per project plans. Note that inspection ports must be installed along the Isolator™ Row and where noted on the plans to allow for inspection of the sediment build up over time.

d. The chambers shall be open-bottomed.

e. The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be built. Chamber models may be cut at the job site to improve site optimization and reduce product waste.

2. End Caps

a. End caps shall be injection molded or roto molded from polyethylene or polypropylene resin and allow pipe connections with polyethylene pipe. End caps shall have a curved face capable of resisting typical horizontal and vertical loads. End caps for MC-3500 and MC-4500 chambers shall be corrugated.

b. All chamber rows shall be terminated with an end cap. End cap placement on end of chamber will vary depending on chamber model.

c. End caps may incorporate cutting guides to allow easy field cutting for various diameters of pipe. Cutting guides shall be located at both the top and bottom of each end cap.

3. Manifold Piping

a. Manifold piping shall be designed to ensure that peak flows are distributed to the rows of chambers without scour of foundation stone.

b. Manifold piping shall be of dual wall HDPE piping such that accepted equations of hydraulics can be used as a basis for design.

4. Stone

a. The foundation, embedment and cover stone shall be in accordance with the chamber manufacturer's installation instructions.

5. Fabric

a. Fabric between the chamber bottom and the stone foundation located along the entire length of the Isolator Row and the first 10.5 ft (SC-310, SC-740, DC-780) or 14.5 ft (MC-3500, MC-4500) of all inlet rows. Fabric shall be AASHTO M288 Class 1 Woven for sediment capture, filtration and scour protection.

b. Fabric between the top of the Isolator Row chambers and the embedment stone and surrounding the entire chamber system shall be AASHTO M288 Class 2 Non-Woven for filtration. (not required over DC-780, MC-3500, or MC-4500 Isolator Row)

c. If required, a thermoplastic liner may be installed around the entire system to prevent water migration. See manufacturer's Tech Sheet #2 for guidance on thermoplastic liners for the system.

2.03 STORMWATER TREATMENT SYSTEMS

A. The stormwater chamber system shall incorporate an Isolator Row for stormwater treatment and system maintenance. An Isolator Row is a chamber row enclosed in geotextile fabric for sediment capture and maintenance.

B. The stormwater treatment system shall remove a minimum of 80% of Total Suspended Solids (TSS), 80% Total Petroleum Hydrocarbons (TPH), 80% Suspended Sediment Concentration, 60% Total Phosphorus, and 60% Total Zinc as verified by 3rd party testing, when requested.

C. Stormwater treatment system inspection and maintenance shall be in accordance with section 3 of this specification and the product manufacturer's published guidance.

2.04 ACCESSORIES

A. Spacers can be used to obtain the required minimum spacing between chamber rows.

B. During construction FlexStorm Catch It inlet filters or pipe plugs on all inlet pipes to the stormwater chamber system shall be used to prevent construction sediment from entering the Isolator Row and chamber storage systems. Pipe plugs to be removed once construction of the system is complete and no further construction sediment loading is expected.

PART 3 EXECUTION

3.01 PREPARATION

A. General

1. Installing contractors are required to use and understand the latest manufacturer's installation instructions prior to beginning system installation.

    a. See Section 1.06 for manufacturer preinstallation meeting information.
    b. Chamber products must be designed and installed in accordance with the manufacturer's minimum requirements. Failure to do so will void the manufacturer's limited warranty.

2. The contractor shall install all drainage structures, pipe and chambers in the locations shown on the design engineer's drawings and/or as approved by the Owner. Pipe shall be of the type and sizes specified on the drawings and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

3. Chambers, pipe and drainage structures shall be inspected prior to installation and any defective or damaged product shall be replaced accordingly.

4. Contact local underground utility companies prior to construction.

5. The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.

B. Site Preparation

1. Excavation must be free of standing water. Dewatering measures must be taken if required.

    a. When groundwater is present in the work area, dewater to maintain stability of in-situ and imported materials. Maintain water level below pipe bedding and foundation to provide a stable trench bottom.

2. Prepare the chamber bed's subgrade soil as outlined in the engineer's drawings. Requirement for subgrade soil bearing capacity should meet or exceed the chamber manufacturer's required allowable subgrade soil bearing capacity. The contractor must report any discrepancies with subgrade soil's bearing capacity to the design engineer.

3.02 CHAMBER INSTALLATION AND BACKFILLING

A. Install chamber system flat or at constant slope between points an elevations indicated.

B. Construct fabric and stone foundation per chamber manufacturer's installation instructions.

C. Construct the chamber bed by joining the chambers lengthwise in rows. Attach chambers by overlapping the end corrugation of one chamber onto the end corrugation of the last chamber in the row.

D. See pipe manufacturer's installation instructions for pipe assembly.

E. Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of the chamber manufacturer's installation instructions.

F. The contractor must refer to the chamber manufacturer's installation instructions for a table of acceptable vehicle loads at various depths of cover. The contractor is responsible for preventing vehicles that exceed the chamber manufacturer's requirements from traveling across or parking over the chamber system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.

G. Refer to the chamber manufacturer's installation instructions for minimum requirements for backfill material above the stormwater chamber system.

H. See pipe manufacturer's installation instructions for guidance on installing the plastic pipe fittings to the chamber system.

3.03 PROTECTION

A. Protect all inlets to the stormwater chamber system during construction. As noted in Section 2.05, pipe plugs in the inlet manhole pipes or FlexStorm Catch It inlet filters may be used to prevent construction sediments from clogging the system. Once construction has ceased, the pipe plugs are removed to allow normal system functionality.

B. All inlet and outlet structures should be protected against construction sediments.

3.04 INSPECTION AND MAINTENANCE

A. As noted in Section 2.02, chambers shall incorporate an optional inspection port to allow for inspection of the stormwater system during normal operations.

   1. Inspection can also be accomplished through the inlet manhole connected to the Isolator Row which may require confined space entry certification of the inspector.

B. Refer to the chamber manufacturer's Isolator Row Operation and Maintenance manual for guidance on inspection intervals during normal system operation

C. Maintenance of the Isolator Row shall utilize a JetVac process to remove sediments that have accumulated in the Isolator Row over time.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 334100 – REINFORCED CONCRETE PIPING

1.01 DESCRIPTION

A. Under this item, the Contractor shall furnish and install reinforced concrete pipe to the line and grade indicated in the contract or directed by the Architect including all required operations specified.

1.02 PROCEDURE

A. Excavated material shall be stockpiled at least two feet away from the edge of the pipe trench.

B. Where existing structures are to be connected to, they shall be exposed for inspection prior to general trench excavation. The cost of this exploratory excavation, as well as connection of pipe to existing structures, will be included in the price bid.

C. Pipe shall be laid from the low end toward the high and with bells up grade. Pipe shall be laid to the line and grade indicated on the plans or as directed by the Architect.

D. Backfill around and over the pipe shall be thoroughly compacted to a minimum of ninety-five percent (95%) maximum density of soil, as determined by the Modified Method of Test for the Compaction and Density of Soils (AASHO T-180) by means approved by the Engineer. This soil shall be compacted in layers not exceeding eight (8) inches loose thickness. Backfill and compaction around the pipe shall be done in such a manner as to not disturb the pipe alignment.

E. Pipe shall be cut off even with the inside face of manholes, catch basins, etc. The cost of this work will be included in the price bid.

1.02 MATERIALS

A. Except as otherwise noted, reinforced concrete pipe shall conform to the local governing authority's Department of Public Works specifications for Class IV Reinforced Concrete Pipe.

1.03 WIDTH OF TRENCH

A. The width of trench in which the pipe is laced shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe.

B. Except as otherwise directed by the Architect or indicated on the drawings, the maximum width of trench shall be the outside diameter of the pipe plus three (3) feet.

1.04 PIPE AND JOINTS

A. Joints shall be formed by caulking into the hub a gasket of jute or oakum and then filled with mortar composed of one part Portland Cement and two parts fine aggregate, or, at the Contractor's option, preformed bituminous caulking compound of a type approved by the Architect may be used; except the joints need not be caulked for slip joint pipe, or for bell and spigot type if provided with approved lock joint, except that a mortar collar will be required.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 334613 – SUBSURFACE DRAINAGE SYSTEM (Foundation Walls)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to install the subsurface drainage material as shown on the drawings and specified herein.

1.02 DESCRIPTION

A. The work under this section of the specifications shall consist of furnishing all labor, materials, equipment, and appliances necessary or required to furnish and install all work of this section as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Provide a three-dimensional drainage composite consisting of a drainage core of fused, entangled nylon filaments and a geotextile fabric bonded to one surface of the core. The composite shall function as a drainage matting designed to dissipate hydrostatic pressure from backfills abutting below-grade structures, collecting accumulated groundwater, and conveying it through a slotted, corrugated drain pipe, to a discharge system, as indicated on the contract documents and as specified herein.

1.03 QUALIFICATIONS

A. To assure unity of responsibility, the material specified in this section shall be furnished and coordinated by the manufacturer. The contractor shall assume responsibility for the satisfactory installation as specified.

1.04 PERFORMANCE REQUIREMENTS

A. The geocomposite drain shall provide a minimum flow capacity of 4.78 gpm/ft. at a hydraulic gradient of 1.0 at a normal pressure of 1,440 psf in Ottawa Sand as tested using the procedure as required in ASTM D-4716.

1.05 SUBMITTALS

A. Submit samples and product data on materials in accordance with Section 013300.

B. Any alternative materials submitted for approval shall include complete design and hydraulic date, including test evidence of compliance to the essential design parameters of the project and reference installations similar in size and scope to that specified for the project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in manufacturer's or distributor's packing, undamaged and complete with installation instructions.

B. Store off ground, under cover, protected from ultra-violet radiation, weather, and construction activities.

PART 2 - PRODUCTS

2.01 GEOCOMPOSITE DRAIN

A. The geocomposite drain shall conform to the following nominal dimensions, weights, and roll values:

1. Nominal dimensions and weights:

Core width (in):	39/78
Roll length (ft):	100
Gross diameter (in):	24
Gross roll weight (lbs.):	38/76
Area/roll (yds^2):	36
Thickness (in):	0.4
Total weight (oz/yd^2):	15.2
Core weight (oz/yd^2):	10.9
Core polymer:	Nylon black plus carbon black

Notation: Fabric bond retained with a 180° inside bend. Longitudinal edge has 3-in. fabric overlap.

2. Geotextile Fabric Properties

	Procedure	Typical Values
Weight (oz/yd2):	ASTM D-3776	4.3
AOS (US Series, sieve #):	ASTM D-4751	70-120
Flow rate (gpm/ft2):	ASTM D-4491	160
Permitivity (sec2):	ASTM D-4491	2.17
Grab strength (lb.):	ASTM D-4632	130
Trapezoidal tear (lb.):	ASTM D-4533	50
Puncture (lb.):	ASTM D-4833	55

3. Exposure (for 80% strength retention) all products:

Temperature range:	-100°F to 250°F
pH range:	3 -12
Fuel submersion:	Stable

2.02 FOOTING DRAIN PIPING

A. Drain piping shall be 4" single wall slotted HDPE corrugated gravity drain piping, ASTM F 405 C.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before beginning installation, the Contractor shall inspect and approve the subsurface installation to insure that the construction is acceptable for the subsurface drain installation and that the perimeter subgrade has been excavated to within ±0.5 feet of design elevation. The Contractor shall report unsatisfactory conditions in writing prior to start of work and shall not proceed until all unsatisfactory conditions have been remedied to the satisfaction of the Architect. By beginning installation, the Contractor signifies his approval of the preceding work.

3.02 INSTALLATION

A. The geocomposite drain shall be installed in vertical strips cut to length, as required, so that the drain is in contact with the walls and footers and drapes over the footer drain pipe. For each strip, the top 5 inches of the core shall be separated for the filter fabric and cut off. The geocomposite drain shall be glued with an approved glue to the subsurface construction with a bead of glue applied to the 5 inches of exposed fabric at the top of each strip with the core against the subsurface construction. The geocomposite drain shall be cut to fit, as required, around wall penetrations such as underground utilities and wrapped tightly around corners in the foundation. At joints between strips, the 3-inch fabric overlap shall be glued continuously to the previously installed strip with an approved glue. Soil or other approved material shall be placed on the bottom of each strip to temporarily hold the geocomposite drain in place against the structure and over the drain pipe until hall work begins. The glue for the seams shall be 3M Fast Bond, Goodyear Pilobond, or approved equal.

3.03 QUALITY ASSURANCE

A. The subsurface drain material shall not be defective, plugged, or otherwise damaged in any way. Any and all such problems shall be corrected by the Contractor at no extra cost to the Owner and to the satisfaction of the Architect.

3.04 CLEAN UP

A. At the completion of the scope of work, the Contractor shall remove from the job site and properly dispose of all remaining debris, waste materials, excess materials, and equipment required of or created by the Contractor. Disposal of waste materials shall be solely the responsibility of the Contractor and be done in accordance with applicable waste disposal regulations.

END OF SECTION