ALTERATIONS TO ADMINISTRATION BUILDING
PEEKSKILL CITY SCHOOL DISTRICT

APN 2226.2A

SED CONTROL NO:

ADMINISTRATION BUILDING 66-15-00-01-0-009-013

VOLUME 2

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Mosaic Associates Architects

The Frear Building, 2 Third Street, Suite 440, Troy, New York 12180
Mosaic Associates Architects, DPC

ADDRESS ALL COMMUNICATIONS REGARDING THIS
PROJECT TO THE ARCHITECT AT THE ABOVE ADDRESS

To the best of my knowledge, information and belief, the plans and specifications are in accordance with applicable requirements of the 2020 New York State Uniform Fire Prevention and Building Code and the State Energy Conservation Construction Code, and State Education Department Building Standards. No new asbestos-containing materials (ACM) or lead materials (LM) shall be used in construction for the above referenced buildings. Work will involve known or suspected (ACM/LM) as evidenced by bulk or destruct testing, and will be REMOVED in accordance with Industrial Code Rule #56 and/or HUD guidelines and OSHA.

May 21, 2025

Architect

SL 01/25

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- **PROJECT BUDGET and CONTACT INFORMATION**
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ASBESTOS ABATEMENT INDEX

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A01092	CODES AND REGULATIONS – ASBESTOS ABATEMENT
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 PROJECT/WORK IDENTIFICATION

A. Contract Documents: Indicate the work of the Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to the following:

1. Applicable Codes and Regulations.
2. Notices and Permits.
3. Existing site conditions and restrictions on use of the site.
4. Alterations and coordination with existing work.
5. Work to be performed subsequent to work under this Contract.
6. Allowances.
7. Requirements for partial Owner occupancy prior to substantial completion of the Contract Work.

1.3 SUMMARY OF REFERENCES

A. Work of the Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions, Specification Sections, Drawings, Addenda and Modifications to the Contract Documents issued subsequent to the initial printing of this project manual and including but not necessarily limited to printed material referenced by any of these. Work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions and other forces outside the Contract Documents.

1.4 SCOPE OF WORK

A. The work includes but is not limited to the removal of asbestos containing materials according to the requirements of the following specification and as follows:

1. Work in this project includes the removal and disposal of the following materials:
   a. Tan ceiling and wall stucco throughout the pool area and corridor in areas shown on the asbestos abatement drawings. All material shall be treated as asbestos-containing material.
   b. Brown mortar at glass brick walls in shower room in areas shown on the asbestos abatement drawings. Glass brick, mortar, and any adjacent surfaces with mortar adhered to it shall be treated as asbestos-containing material.
   c. All material specified or shown to be removed shall be considered as containing asbestos and removal shall be in accordance with specifications for removal of asbestos containing materials.

2. If the Contractor uses any patented or licensed systems or equipment, etc., he shall pay all patent, licensing, use, etc., charges.
3. All notification fees and applications for variances shall be paid by the contractor.

B. General and Administrative Requirements: Are set forth in the following specification sections:

1. Summary of the Work - Asbestos Abatement.
2. Project Coordination - Asbestos Abatement.
3. Definitions and Standards - Asbestos Abatement.
4. Schedules, Reports, Payments - Asbestos Abatement.
5. Shop Drawings, Product Data and Samples.
6. Products and Substitutions.

C. Abatement Work: Requirements are set forth in the following specification sections, listed here according to the sequence of the work:

1. A01092 Codes and Regulations - Asbestos Abatement: Sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.
2. A01503 Temporary Facilities - Asbestos Abatement: Sets forth the support facilities needed such as electrical and plumbing connections for the decontamination unit and office space for the Project Administrator.
3. A01526 Temporary Enclosures: Details the requirements for the sheet plastic barriers isolating the work area from the balance of the building.
4. A01410 Air Monitoring - Test Laboratory Services: Describes air monitoring by Owner so that the building beyond the work area will remain uncontaminated. Air monitoring to determine required respiratory protection is the responsibility of the Contractor.
5. A01563 Decontamination Units: Explains the setup and operation of the personnel and material decontaminations units.
6. A01513 Negative Pressure System: Sets forth the procedures to set up the negative air machines and ventilation of the work area.
7. A01560 Worker Protection - Asbestos Abatement: Describes the equipment and procedures for protecting workers against asbestos contamination and other work place hazards except for respiratory protection.
8. A01562 Respiratory Protection: Sets forth the procedures and equipment required for adequate protection against inhalation of airborne asbestos fibers.

D. Asbestos Removal Work Procedures: Are described in the following specification sections:

1. A02081 Removal of Asbestos Containing Materials.
2. A02084 Disposal of Asbestos Containing Waste Material.

E. Decontamination of the Work Area: After completion of abatement work is described in the following sections:

1. A01711 Project Decontamination: Describes the sequence of cleaning and decontamination procedures to be followed during removal of the sheet plastic barriers isolating a work area.
2. A01714 Work Area Clearance: Describes the analytical methods used to determine if the work area has been successfully cleaned of contamination.
3. A01701 Project Closeout: Details the closeout procedures to end the project once abatement work is complete including final paperwork requirements.

1.5 PLAN OF ACTION

A. Submit a detailed plan on form provided of the procedures proposed for use in complying with the requirements of this specification. Include in the plan the location and layout of decontamination areas, the sequencing of asbestos work, the interface of trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the site, disposal plan including location of approved disposal site, and a detailed description of the methods to be employed to control pollution. Expand upon the use of portable HEPA ventilation system, closing out of the building's HVAC system, method of removal to prohibit visible emissions in work area, and packaging of removed asbestos debris. The plan must be approved by the Owner's Representative prior to commencement of work.

1.6 POTENTIAL ASBESTOS HAZARD

A. The disturbance or dislocation of asbestos-containing materials may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to workmen and building occupants. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the jobsite of the seriousness of the hazard and of proper work procedures which must be followed.

B. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos-containing materials, take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable Federal, State and Local agencies.

C. If the Owner, the Owner's Representative, or the Project Administrator presents a written stop work order, immediately and automatically stop all work. Do not commence work until authorized in writing by Owner's Representative.

1.7 CONTRACTOR USE OF PREMISES

A. General: The Contractor shall limit his use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public.

B. Use of the Site: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

C. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials.

1.8 CONTRACTOR'S USE OF THE EXISTING BUILDING

A. Maintain existing building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

B. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste, rubbish or construction debris.

C. Smoking or open fires will not be permitted within the building enclosure or on the premises.

1.9 OWNER OCCUPANCY

A. Full Owner Occupancy: Owner will occupy the site and portions of the existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and to facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.

1.10 SUBMITTALS

A. Submit as required by each section. Refer to Section A01340 "Shop Drawings, Product Data And Samples" for Submittal Checklist.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION A01043 - PROJECT COORDINATION - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Minimum administrative and supervisory requirements necessary for coordination of work on the Project include but are not necessarily limited to the following:

1. Administrative and supervisory personnel.
2. Special Reports.
3. Notifications to other entities at job site.

1.3 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General Superintendent: Provide a full-time General Superintendent who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by OSHA in 29 CFR 1926 for the Contractor and is the Contractor's representative responsible for compliance with all applicable Federal, State, and Local Regulations, particularly those relating to asbestos-containing materials. This person must have completed a course at an EPA Training Center or equivalent certificate course in asbestos abatement procedures, have had a minimum of 2 years on-the-job training and meet any additional requirements set forth in 29 CFR 1926 for a Competent Person. Supervisors must be currently certified as outlined in the Federal Register of April 30, 1987 Appendix C to Subpart E, 40 CFR 763.

1.4 SPECIAL REPORTS

A. General: Except as otherwise indicated, submit special reports directly to Owner within one day of occurrence requiring special report, with copy to Owner's Representative and others affected by occurrence.

B. Reporting Unusual Events: When an event of unusual and significant nature occurs at site (e.g., failure of negative pressure system, rupture of temporary enclosures), prepare and submit a special report listing chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise Owner in advance at earliest possible date.

C. Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.5 CONTINGENCY PLAN

A. Contingency Plan: Prepare a contingency plan for emergencies including fire, accident, power failure, negative air system failure, supplied air system failure, or any other event that may require modification or abridgement of decontamination or work area isolation

procedures. Include in plan specific procedures for decontamination or work area isolation. Note that nothing in this specification should impede safe exiting or providing of adequate medical attention in the event of an emergency.

B. Post: In clean room of Personnel Decontamination Unit telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, police, power company, telephone company.

1.6 NOTIFICATIONS

A. Notify other entities at the job site of the nature of the asbestos abatement activities, location of asbestos containing materials, requirements relative to asbestos set forth in these specifications and applicable regulations.

1.7 SUBMITTALS

A. Before the Start of Work: Submit the following to the Owner's Representative for review. No work shall begin until these submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1. Contingency Plans: For emergency actions.
2. Telephone Numbers: And location of emergency services.
3. Notifications: Sent to other entities at the work site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General Explanation: A substance amount of specification language constitutes definitions for terms found in other contract documents, including the drawings. (Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated thereon). Certain terms used in contract documents are defined in this article. Definitions and explanations of this section are not necessarily neither complete nor exclusive, but are general for the work to the extent they are not stated more explicitly in another element of contract documents.

B. General Requirements: The provisions or requirements of Division 1 sections and Asbestos Abatement sections apply to entire work of Contract and, where so indicated, to other elements which are included in project.

C. Indicated: The term "Indicated" is a cross-reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

D. Directed Requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" means "directed by Owner's Representative," "requested by "Owner's Representative," and similar phrases. However, no such implied meaning will be interpreted to extend Owner's Representative's responsibility into Contractor's responsibility for construction supervision.

E. Approve: Where used in conjunction with Owner's Representative's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of Owner's Representative's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Owner's Representative be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents.

F. Project Site: The term "project site" is defined as the space available to Contractor for performance of the work, either exclusively or in conjunction with others performing other work as part of the project. The extent of project site is shown on the drawings, and may or may not be identical with the description of land upon which the project is to be built.

G. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

H. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing protecting, cleaning and similar operations, as applicable in each instance.

I. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

J. Installer: The term "installer" is defined as the entity (person or firm) engaged by Contractor, or its subcontractor or sub-subcontractor for performance of a particular unit of work at project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

K. Testing Laboratory: The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or test of the work, either at project site or elsewhere, or to report and (if required) interpret results of those inspections or tests.

L. Owner's Representative: is the entity described as the "Architect" in "General Conditions of the Contract for Construction". All references to Architect or Engineer in the contract documents shall in all cases refer to the Owner's Representative. The Owner's Representative will represent the Owner during construction and until final payment is due. The Owner's Representative will advise and consult with the Owner. The Owner's instructions to the Contractor shall be forwarded through the Owner's Representative.

M. Project Monitor: Is the entity described as the "Project Representative" or "Clerk of the Works" in "General Conditions of the Contract for Construction". The Project Administrator is a full time representative of the Owner at the job site with authority to stop the work upon verbal order if requirements of the contract documents are not met, or if in the sole judgement of the Project Administrator, Owner's Representative, Owner, the interests of the Owner, safety of any person or the Owner's property are jeopardized by work.

N. General Superintendent: Is the Contractor's representative at the work site. This person will generally be the competent person required by OSHA in 29 CFR 1926.

1.3 DEFINITIONS RELATIVE TO ASBESTOS ABATEMENT

A. Accredited or Accreditation: When referring to a person or laboratory means that such person or laboratory is accredited in accordance with Section 206 of Title II of the Toxic Substance Control Act (TSCA).

B. Aerosol: A system consisting of particles, soil or liquid, suspended in air.

C. Air Cell: Insulation normally used on pipes and duct work that is comprised of corrugated cardboard which is frequently comprised of asbestos combined with cellulose or refractory binders.

D. Air Monitoring: The process of measuring the fiber content of a specific volume of air.

E. Amended Water: Water to which a surfactant has been added.

F. Asbestos: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummington-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

G. Asbestos-Containing Material (ACM): When referring to school buildings means any material contaminated with an asbestos-containing material which is to be removed from a work area for disposal.

H. Authorized Visitor: The Owner, the Owner's Representative, testing lab personnel, the Architect/Engineer or a representative of any Federal, State and Local regulatory or other agency having authority over the project.

I. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

J. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

K. Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

L. Certified Industrial (Hygienist (C.I.H.): An industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.

M. Demolition: The wrecking or taking out of any building component, system, finish or assembly of a facility together with any related handling operations.

N. Disposal Bag: 6 mil thick leak-tight plastic bags used for transporting asbestos waste from work and to disposal site. Each is labeled as follows:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

and

CAUTION
Contains Asbestos Fibers
Avoid opening or Breaking Container
Breathing Asbestos Is Hazardous To Your Health

and

RQ HAZARDOUS SUBSTANCE
SOLID, NOS,
ORM-E, NA 9188
(ASBESTOS)

O. Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix, to prevent release of fibers.

1. Bridging Encapsulant: An encapsulant that forms a discrete layer on the surface of an in situ asbestos matrix.
2. Penetrating Encapsulant: An encapsulant that is absorbed by the in situ asbestos matrix without leaving a discrete surface layer.
3. Removal Encapsulant: A penetrating encapsulant specifically designed for removal of asbestos-containing materials rather that for in situ encapsulation.

P. Encapsulation: Treatment of asbestos-containing materials, with an encapsulant.

Q. Enclosure: The construction of an air-tight, impermeable, permanent barrier around asbestos-containing material to control the release of asbestos fibers into the air.

R. Filter: A media component used in respirators to remove solid or liquid particles from the inspired air.

S. Friable: When referring to material in a building means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously nonfriable material after such previously nonfriable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

T. Glovebag: A sack (typically constructed of 6 mil transparent polyethylene or polyvinylchloride plastic) with two inward projecting long-sleeved gloves, which are designed to enclose an object from which an asbestos-containing material is to be removed.

U. High-efficiency particulate air: (HEPA) refers to a filtering system capable of trapping and retaining 99.97 percent of all monodispersed particles 0.3 microns diameter or larger.

V. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air (absolute) filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97 percent efficiency for retaining fibers of 0.3 microns or larger.

W. High-Efficiency Filter: A filter which removes from air 99.97 percent or more of monodisperse dioctyl phthalate (DOP) particles having a mean particle diameter of 0.3 microns.

X. Negative Pressure Respirator: A respirator in which the air pressure inside the respirator covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

Y. Negative Pressure Ventilation System: A local exhaust system, utilizing HEPA filtration capable of maintaining a negative pressure inside the work area and a constant air flow from adjacent areas into the work area and exhausting that air outside the work area.

Z. Negative Pressure: Air pressure lower than surrounding areas, generally caused by exhausting air from a sealed space (work area).

AA. Personal Monitoring: Sampling of the asbestos fiber concentrations within the breathing zone of an employee.

BB. Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

CC. Repair: Means returning damaged ACM to an undamaged condition or to an intact state so as to prevent fiber release.

DD. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.

EE. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

FF. Time Weighted Average (TWA): The average concentration of a wearer from in air during a specific time period.

GG. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed quantity water vapor.

HH. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and object by using cloths, mops or other cleaning utensils which have been dampened with amended quantity or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos contaminated waste.

II. Work Area: The area where asbestos related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers or debris, and entry by unauthorized personnel. Work area is a Regulated Area as defined by 29 CFR 1926.

JJ. Overlapping and Conflicting Requirements: Where compliance with 2 or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into contract documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal- but-different requirements, and uncertainties as to which level of quality is more stringent, to Owner's Representative for a decision before proceeding.

KK. Contractor's Options: Except for overlapping or conflicting requirements, where more than one set of requirements are specified for a particular unit of work, option is intended to be Contractor's regardless of whether or not it is specifically indicated as such.

LL. Minimum Quality/Quantity: Quality level or quantity shown or specified is intended to be the minimum for the work to be performed. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of the requirements. Refer instances of uncertainty to Owner's Representative for decision before proceeding.

1.4 INDUSTRY STANDARDS

A. General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, applicable standards of the construction industry have the same force and effect (and are made a part of contract documents by reference) as if copied directly into contract documents, or as if published copies were bound herewith. Refer to the other contract documents for resolution from the application of several different industry standards to the same unit of work. Refer to individual unit of work sections for indications of which specialized codes and standard the Contractor must keep at the project site, available for reference.

B. Reference Standards: (referenced directly in contract documents or by governing regulations) have precedence over non-referenced standards which are recognized in industry for applicability to work.

C. Non-referenced standards are hereby defined to have particular applicability to the work, except as general requirements of whether the work complies with standards recognized in the construction industry.

D. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

E. Updated Standards: At the request of the Owner's Representative, submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the contract documents and before the performance of the work affected. The Owner's Representative will decide whether to issue the change order to proceed with the updated standard.

F. Copies of Standards: The contract documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with recognized industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contract documents.

1. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.
2. Although certain copies of standards needed for enforcement of the requirements may be required submittals, the Owner's Representative reserves the right to require the Contractor to submit additional copies of these standards as necessary for enforcement of the requirements.

G. Abbreviations and Names: Where acronyms or abbreviations are used but not identified in specifications or other contract documents they are defined to mean the industry recognized name of trade association, standards generating organization, governing authority or other entity applicable to context of text provision. Refer to "Encyclopedia of Associations," published by Gale Research Co., available in large libraries.

H. Abbreviation and Names: The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of date of contract documents:

AIA	American Institute of Architects New York Ave. NW; Washington, DC 202/626-7474
ANSI	American National Standards Institute Broadway; New York, NY 10018
ASHRAE	American Society for Heating, Refrigerating, and Air Conditioning Engineers Tullie Circle NE; Atlanta, GA 404/636-8400
ASTM	American Society for Testing and Materials Race St.; Philadelphia, PA 19103

CFR	Code of Federal Regulations Available from Government Printing Office Washington, DC (usually first published in Federal Register)
CGA	Compressed Gas Association Jefferson Davis Highway Arlington, VA 22202 703/979-0900
CS	Commercial Standard of NBS (U.S. Dept. of Commerce) Government Printing Office Washington, DC 20402
DEC	Department of Environmental Conservation Wolf Road Albany, New York 12205
EPA	Environmental Protection Agency M St., SW; Washington, DC 20406
FS	Federal Specification (General Services Admin.) Obtain from your Regional GSA Office, or purchase from GSA Specifications Unit (WFSIS); 7th and D Streets, SW, Washington, DC 20406
GS	Gypsum Association Orrington Ave.; Evanston; IL 60201
GSA	General Services Administration St. and 18th St., NW; Washington, DC 202/655-4000
MIL	Military Standardization Documents Dept. of Defense) Naval Publication and Forms Center Tabor Ave., Philadelphia, PA 19120
NBS	National Bureau of Standards S. Dept. of Commerce), Gaithersburg, MD 20234
NEC	National Electrical Code (by NFPA)
NFPA	National Fire Protection Association Batterymarch Park, Quincy, MA 02269
NYSDOL	New York State Labor Department Bureau of Public Work State Office Building Campus, Albany, NY 12240
OSHA	Occupational Safety Health Administration S. Dept. of Labor) Government Printing Office; Washington, DC 20402

SED	New York State Education Department Division of Educational Facilities Planning Education Building Annex Washington Avenue Albany, New York 12234 474-3906
UL	Underwriters Laboratories 333 Pfingsten Rd. Northbrook, IL 60062

I. Trade Union Jurisdiction: It is a procedural requirement that the Contractor maintain, and require prime subcontractors to maintain, complete current information on jurisdictional matters, regulations actions and pending actions, as applicable to the work. Discuss new developments at appropriate project meetings at the earliest feasible dates, and records information of relevance along with the action agreed upon. The Manner in which contract documents have been organized and subdivided is not intended to be an indication of jurisdictional or trade union agreements. Assign and subcontract the work, and employ tradesmen and laborers, in a manner which will not unduly risk jurisdictional disputes of a kind which could result in conflicts, delays, claims and losses in the performance of the Work.

1.5 SUBMITTALS

A. Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.

1.3 CODES AND REGULATIONS

A. General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

B. Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State and Local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and Local regulations. The Contractor shall hold the Owner and Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his subcontractors.

C. Federal Requirements: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), including but not limited to:

    a. Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; 29 CFR 1910.1001 and 29 CFR 1926.1101.
    b. Respiratory Protection; 29 CFR 1910.134.
    c. Safety and Health Regulations for Construction; 29 CFR 1926.
    d. Access to Employee Exposure and Medical Records; 29 CFR 1910.1020.
    e. Hazard Communication; 29 CFR 1910.1200.
    f. Specifications for Accident Prevention Signs and Tags; 29 CFR 1910.145.

2. U.S. Environmental Protection Agency (EPA) including but not limited to:

    a. “Asbestos Containing Materials in Schools” Final Rule and Notice; 40 CFR 763, Subpart E.
    b. General Provisions; 40 CFR 61, Subpart A.
    c. “National Emission Standard for Asbestos;” 40 CFR 61, Subpart M.
    d. 40 CFR Part 64 - Compliance Assurance Monitoring

D. State Requirements: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. New York State Department of Environmental Conservation (DEC) Regulations regarding waste collector registration; 6 NYCRR 364.
2. New York State Department of Labor (DOL): Industrial Code Rule 56 (12 NYCRR 56) and all applicable variances issued.
3. An annual "Industrial Waste Hauler Permit" specifically for asbestos-containing materials is required for transportation of asbestos-containing waste to disposal site.
4. New York State Department of Health (NYSDOH) Asbestos Safety Program Requirements; 10 NYCRR 73.

E. Local Requirements: Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

1.4 STANDARDS

A. Standards which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. ANSI Z288.2-2015 - Practices for Respiratory Protection.
2. AFL-CIO - Asbestos Standard For Construction - Building And Construction Trades Department.
3. AWCI - Guide Specifications For The Abatement Of Asbestos Release From Spray Or Trowel Applied Materials In Buildings And Other Structural Designs.
4. General Services Administration - Asbestos Control Program, "Guidelines For Assessment And Abatement Of Asbestos Containing Material In Buildings;" NBSIR 87-2688.

1.5 NOTICES

A. U.S. Environmental Protection Agency:

1. Send written notification as required by USEPA "National Emission Standards for Hazardous Air Pollutants" (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) to the regional Asbestos NESHAPS Contact at least 10 days prior to beginning any work on asbestos-containing materials. Send notification to the following address:

EPA Region 2
Air Branch
290 Broadway, 21st Floor
New York, New York 10007
212-637-3476

2. Notification: Include the following information in the notification sent to the NESHAPS Contact:

a. Name and address of Owner or Operator.
b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
c. Location of the facility being demolished or renovated.

d. Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of friable asbestos materials is less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, explain techniques of estimation.
e. Scheduled starting and completion dates of demolition or renovation.
f. Nature of planned demolition or renovation and method(s) to be used.
g. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M).
h. Name and location of the waste disposal site where the friable asbestos waste material will be deposited.

1.6 STATE AND LOCAL AGENCIES

A. Send written notification as required by State and Local regulations prior to beginning any work on asbestos-containing materials, on forms provided by the Agency.

1.7 PERMITS

A. Permit: An annual "Industrial Waste Hauler Permit" specifically for asbestos-containing materials, is required for transporting of waste asbestos-containing materials to a disposal site.

1.8 LICENSES

A. Licenses: Maintain current licenses as required by applicable State or Local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the Work of this contract.

B. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State and Local regulations above. Post one copy of each at the job site. Keep one copy of each in Contractor's office.

1.9 SUBMITTALS

A. Before Start of Work: Submit the following to the Owner's Representative for review. No work shall begin until these submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1. State and Local Regulations: Submit copies of Codes and Regulations applicable to the work.
2. Notices: Submit notices required by Federal, State and Local regulations together with proof of timely transmittal to agency requiring the notice.
3. Permits: Submit copies of current valid permits required by state and local regulations.
4. Licenses: Submit copies of all state and local licenses and permits necessary to carry out the work of this contract.

1.10 MULTI-EMPLOYER WORKSITES (Excerpted from Industrial Code Rule 56, 2006 version and applicable to EVERY job)

A. All asbestos abatement contractors on a demolition, renovation, remodeling, or repair project, which includes work covered by this Part, shall inform all employers on the work

site about the nature of their work, as well as the Presumed Asbestos Containing Materials (PACM), Asbestos Containing Materials (ACM) and asbestos material (known and assumed) at the work site. The asbestos abatement contractor shall inform all non-asbestos contractors at the work site that disturbance of PACM, ACM and asbestos material (known and assumed) is prohibited by any employer other than a licensed asbestos contractor.

B. The asbestos abatement contractor shall notify the building/structure owner and all employers and occupants located in areas adjacent to a Phase II regulated abatement work area, of the following occurrences: all elevated air sample results, work stoppage and barrier inspection/repairs completed as required by Industrial Code Rule 56, Section 56-4.10 of this Part. This notification shall be made on the same calendar day that the asbestos abatement contractor is notified by the air monitor of elevated air sample results.

C. All non-asbestos contractors on a demolition, renovation, remodeling, or repair project, which includes work covered by this Part, are responsible to notify the building owner or their representative, upon discovery of PACM or suspect miscellaneous ACM that has not been identified by the asbestos survey per this Part, or has not been identified by other inspections as per current OSHA or EPA requirements. The presence, location, and quantity of newly discovered material, shall be conveyed within 24 hours of discovery to the building owner or their representative, as well as to all other employers at the work site. All activities shall cease in the area where the PACM or suspect miscellaneous ACM is found, until a licensed asbestos contractor appropriately assesses and handles the discovered materials. Disturbance of PACM, ACM and asbestos material (known and assumed) at the work site, is prohibited by any non-asbestos contractor.

D. Prior to commencement of any demolition, renovation, remodeling or repair project, which includes work covered by this Part, the building owner or their designated representative shall inform all employers reasonably expected to be at the work site during the project, about the presence, location and quantity of PACM, ACM and asbestos material (known and assumed) within the portion of their building or structure impacted by the project.

E. All contractors performing a supervisory role on a demolition, renovation, remodeling or repair project, that includes work covered by this Part, shall prohibit disturbance of PACM, ACM or asbestos material (known or assumed) by non-asbestos contractors at the work site under their direct supervision and control, and shall require all asbestos contractors at the work site under their direct supervision and control to be in compliance with this Part.

1.11 RESPONSIBILITY FOR CLEANUP OF UNCONTROLLED DISTURBANCE

A. If there is an incidental disturbance or other disturbance (not as part of a controlled asbestos project) of ACM, PACM, asbestos material, or suspect miscellaneous ACM assumed to be ACM at a building or structure, upon discovery of the disturbance, the property owner shall be responsible for contracting with a licensed asbestos contractor for immediate isolation of the disturbance and cleanup in accordance with all provisions of this Part.

1.12 OTHER CODES

A. All other Codes shall apply, including but not limited to, the “New York State Uniform Fire Prevention and Building Code” or its successor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 COORDINATION

A. General Construction Contractor and Asbestos Subcontractor shall coordinate both the listing and timing of reports and activities required by provisions of this section and other sections, so as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the work including the Owner's Representative and Owner. In particular provide close coordination of the progress schedule, schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

1.3 PROGRESS SCHEDULE

A. Schedules: General Construction Contractor and Asbestos Subcontractor shall provide proposed detailed schedule including work dates, work shift time, number of employees, dates of start and completion including dates of preparation work, removals and final inspection dates.

1.4 PROGRESS MEETINGS

A. General: In addition to specific coordination and pre-installation meetings for each element of work and other regular project meetings held for other purposes, Owner's Representative will hold general progress meetings as required and scheduled, where possible, with preparation of payment request. Require each entity then involved in planning, coordination or performance of Work to be properly represented at each meeting.

1.5 PRE-CONSTRUCTION CONFERENCE

A. Initial progress meeting, recognized as "Pre-Construction Conference": Prior to start of any work, General Construction Contractor and Asbestos Subcontractor shall meet at project site, with General Superintendent, Owner, Owner's Representative, Project Administrator, and other entities concerned with asbestos abatement work. Record discussions and agreements and furnish copy to each participate. Provide at least 72 hours advance notice to all participants prior to convening Pre-Construction Conference.

B. This is an organizational meeting, to review responsibilities and personnel assignments, to locate the containment, and decontamination areas and temporary facilities including power, light, water, etc.

1.6 REPORTING

A. Daily Log: Maintain within the Decontamination Unit a daily log documenting the dates and times of, but not limited to, the following items:

1. Meetings; purpose, attendees, discussion (brief).
2. Visitations; authorized and unauthorized.

3. Personnel, by name, entering and leaving the work area.
4. Special and unusual events, e.g., barrier breaching, equipment failures, etc.
5. Air monitoring tests and test results.

B. Documentation, with confirmation signature of Owner's Project Administrator, of the following:

1. Inspection of work area preparation prior to start of removal and daily thereafter.
2. Removal of any polyethylene barriers.
3. Contractors inspections prior to encapsulation.
4. Removal of waste materials from work area.
5. Decontamination of equipment (list items).
6. Contractor’s final inspection/final air test analysis.

C. Provide two copies of this log at final closeout of project for use by the Owner.

1.7 SCHEDULE OF VALUE

A. See Section 012900 “Payment Procedures” for Schedule of Value requirements.

1.8 APPLICATION FOR PAYMENT

A. See Section 012900 “Payment Procedures” for Application for Payment requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION A01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF REQUIREMENTS

A. General: Section specifies procedural requirements for non-administrative submittals including shop drawings, product data, samples and other miscellaneous work-related submittals. Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Refer to other Division 1 sections and other contract documents for specifications on administrative, non-work-related submittals. Such submittals include, but are not limited to the following items:

1. Permits.
2. Payment Applications.
3. Performance and Payment Bonds.
4. Insurance Certificates.
5. Inspection and Test Reports.

C. Shop Drawings are technical drawings and data that have been specially prepared by or on behalf of Contractor for this project, including but not limited to the following items:

1. Fabrication and installation drawings.
2. Schedules
3. Contractor's engineering calculations.

D. Standard information prepared without specific reference to a project is not considered to be shop drawings.

E. Product Data includes standard printed information on manufactured products that has not been specially- prepared for this project, including but not limited to the following items:

1. Manufacturer's product specifications and installation instructions.
2. Catalog cuts.

F. Samples are physical examples of work, including but not limited to the following items:

1. Small cuts or containers of materials.

G. Miscellaneous submittals are work-related, non-administrative submittals that do not fit in the three previous categories, including, but not limited to the following:

1. Workmanship Bonds.
2. Survey Data and Reports.
3. Project Photographs.
4. Testing and Certification Reports.
5. Record Drawings.

6. Field Measurement Data.

1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.

B. Scheduling: In each appropriate administrative submittal, such as the progress schedule, show the principal work-related submittals and time requirements for coordination of submittal activity with related work.

C. Review Time: Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the Owner's Representative on each submittal, as to whether processing time is critical to the progress of the work, and if the work would be expedited if processing time could be shortened.

D. Allow two weeks for the Owner's Representatives initial processing of each submittal. Allow a longer time period where processing must be delayed for coordination with subsequent submittals. The Owner's Representative will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

E. Allow one week for reprocessing each submittal.

F. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Owner's Representative sufficiently in advance of the work.

G. Transmittal Form: 013300F2-Mosaic-Submittal-Cover-Sheet.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. General: Specific submittal requirements for individual units of work are specified in the applicable specification section. Except as otherwise indicated in the individual specification sections, comply with the requirements specified herein for each type of submittal.

B. Shop Drawings: Information required on shop drawings includes, dimensions, identification of specific products and materials which are included in the work, compliance with specified standards and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Highlight, encircle or otherwise indicate deviations from the contract documents on the shop drawings.

C. Do not permit shop drawings copies without an appropriate final "Action" marking by the Owner's Representative to be used in connection with the work.

D. Preparation: Submit newly prepared information, drawn to accurate scale on sheets not less than 8-1/2 by 11 inches, except for actual pattern or template type drawings, the maximum sheet size shall not exceed 24 by 36 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block. Provide a space not less than 20 sq. in. beside the title block for marking the record of the review process and the Owner's Representative's "Action" marking.

E. Do not reproduce contract documents or copy standard printed information as the basis of shop drawings.

F. Electronic Submittals: Prepare submittals as a PDF package, incorporating complete information into each PDF file.

G. Final Submittal: Provide 3 prints plus 2 additional prints where they are required for maintenance manuals, plus the number of prints needed by the Owner's Representative for distribution to others. 2 prints will be retained; the remainder will be returned. One of the prints returned is to be marked up and maintained by the Contractor as a "Record Document".

H. Product Data: General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals (if any), special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

I. Submittals: Product data submittal is required for information and record and to determine that the products, materials and systems comply with the provisions of the contract documents. Therefore, the initial submittal is also the final submittal, except where the Owner's Representative observes that there is non-compliance with the provisions of the contract documents and returns the submittal promptly to the Contractor marked with the appropriate "Action".

J. Installation Copy: Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the Installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

K. Samples: Submit samples for the Owner's Representative's visual review of general generic kind, color, pattern, and characteristics with other related elements of the work. Samples are also submitted for quality control comparison of these characteristics between the final sample submittal and the actual work as it is delivered and installed.

L. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship, control testing at the point of production. Process inspection and test reports accordingly.

M. Warranties: Refer to Section "Products and Substitutions" for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreement. In addition to copies desired for the Contractor's use, furnish pdf copy executed of such warranties, bonds or agreements. Provide 2 additional copies where required for maintenance manuals.

1. Project Photographs: Furnish pdf copy each of project photographs taken at hourly intervals during abatement, cleaning and clearance. Comply with Owner's Representative's direction concerning desired vantage points for shots.

N. Closeout Submittals: Refer to section "Project Closeout" and to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

1. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings provide (1 pdf copy).
2. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 OWNER'S REPRESENTATIVE'S ACTION

A. General: Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Owner's Representative will review each submittal, mark with appropriate "Action", and where possible return within a reasonable time of receipt. Where the submittal must be held for coordination the Owner's Representative will so advise the Contractor without delay.

SUBMITTAL CHECKLIST

Pre-bid

_____Company resume, including:
List of projects completed with phone numbers and person to contact, type of respiratory protection used, and project budgets. Also include number of years in the asbestos abatement business.
List of equipment, including number of negative air machines, HEPA vacuums, etc.

_____Bid Bond and Bid Bond Certification (signed by Surety)
_____Signed non-collusive bidding certificate
_____Signed Bid Form, with amounts for base bid, all alternates, and all allowances included
_____Evidence of insurance coverage with no exclusions for asbestos related work
_____New York State Asbestos Handling license
_____AHERA Accreditations for Contractor and Workers

Before Start of Work

_____Medical exam results for each worker, including medical history, chest X-ray, and pulmonary function test results
_____Worker training certificates for each worker, supervisor
_____Respiratory protection program
_____Schedule of values
_____Work progress schedule
_____Copy of EPA Notification
_____Copy of notification to N.Y.S. Department of Labor
_____Copy of Waste Hauler Permits
_____Copy of Landfill Notification
_____List of Subcontractors
_____Insurance Certificates
_____Evidence of Performance Bond, Labor and Material Bond
_____Testing lab to be used by Contractor for personal air sample analysis
_____Respiratory equipment

_____Supplied air (Type C) respiratory system/equipment, including all components (compressor, air purifiers, hoods, masks, CO monitors, backup air supply, alarms, air coolers, air hose, etc.), NIOSH and MSHA certificates for all components, system diagram, resume of individual monitoring system.
Powered air purifying respirators (PAPR), with NIOSH and MSHA certificates
_____HEPA vacuums
_____Negative air machines
_____Polyethylene sheeting, duct tape
_____Worker's compensation insurance certificates
_____Encapsulants
NA Encapsulating cloth/patching materials
NA Fireproofing (respray after removals)
_____Contractor's air sampling equipment
NA Gypsum drywall products
NA Ceiling systems/ceiling tiles
NA High Pressure washing equipment
NA Temporary heating equipment
NA Ear/hearing protection equipment
_____Any changes in drawings relative to decontamination units preparation details, or other deviations from specifications or drawings
_____Disposable suits
_____Personnel Decontamination Unit
_____Equipment Decontamination Unit
_____Emergency evacuation plans for work area
_____Historic airborne fiber data
_____Contractor's NYS Asbestos Handler License, and Worker's Certificates
_____Contractors AHERA Accreditations

Post Job/Pre-Closeout

_____Resume of Project Foreman
_____Landfill receipts on a monthly basis
_____Contractor's daily log
_____Complete “Summary of Asbestos Work Performed” document.
_____Completion of closeout requirements as set forth in Section A01701.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

Summary of Asbestos Work Performed

(use additional sheets if necessary)

DOCUMENT ALL WORK PERFORMED ON AS-BUILT DRAWINGS TO BE TURNED OVER TO THE OWNER AT COMPLETION OF REMOVALS.

Building Name: _____ Date Performed: _____

Functional Space Room Number (1)	Type of Material Removed (2)	Where Material Found / Located (3)	Homogeneous Area (4)	Total Quantity Removed in L.F. or S.F. (5)	Removal Method (6)

(1) Use functional space number from Architectural Drawings.

(2) Acoustical/Decorative Plasters (ADP) / Fireproofing Materials (FM) / Troweled Wall/Ceiling Plasters (TCP) / Mud Joints/Tees (MJT)
Pipe Covering (List Size Pipe) (PC) / Boiler/Hot Water Tank Insulations (BHTI) / Panels/Ceiling Tiles (PCT) / Transite Panels (TP)
Vent/Drain Pipes (List Size) (VDP) / In-Place Gasket (IPG) / Vinyl Asbestos Siding (VAS) / Vinyl Asbestos Tile (VAT) / Other (Describe) (O)

(3) Enter ceiling, walls, pipe, duct, ceiling tile, floor tile, or similar description where material was located within room.

(4) If identified by homogeneous sampling, list homogeneous area number from Asbestos Management Plan.

(5) Enter the measured area (sf) or length (lf) of material removed.

(6) wet, dry, glovebag, tent, other

ASBESTOS CONTRACTOR:

Name _____ Asbestos Lic #. _____

Address _____ Expiration Date: _____

_____

Phone No. _____ Contract Date: _____

END OF SECTION

SECTION A01410 - AIR MONITORING-TEST LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Air Monitoring: During work area clearance is described in Section A01714 "Work Area Clearance".

1.2 SUMMARY

A. Section describes air monitoring carried out by the Owner to verify that the building beyond the work area and the outside environment remain uncontaminated. This section also sets forth airborne fiber levels both inside and outside the work area as action levels, and describes the action required by the Contractor if an action level is met or exceeded.

B. Air monitoring required by OSHA is work of the Contractor and is not covered in this section.

1.3 AIR MONITORING

A. Work Area Isolation: The purpose of the Owner's air monitoring will be to detect faults in the work area isolation such as:

1. Contamination of the building outside of the work area with airborne asbestos fibers.
2. Failure of filtration or rupture in the negative pressure system.
3. Contamination of the exterior of the building with airborne asbestos fibers.

B. Should any of the above occur, the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Work shall not recommence until authorized by the Owner's Representative.

C. Work Area Airborne Fiber Count: The Contractor will monitor airborne fiber counts in the work area. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

D. Work area clearance to determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the Contractor will sample and analyze air per Section A01714.

E. The Owner and Contractor will be conducting air monitoring throughout the course of the project.

1.4 AIRBORNE FIBER COUNTS

A. Inside Work Area: Maintain an average airborne count in the work area of less than 0.5 fibers per cubic centimeter. If the fiber counts rise above this figure for any sample taken, revised work procedures to lower fiber counts. If the Time Weighted Average (TW) fiber count for any work shift or 8 hour period exceed 0.5 fibers per cubic centimeter, stop all work, leave negative air system in operation and notify Owner's Representative. Do not recommence work until cleanup is completed, new procedures are established, and fiber counts are less than 0.1 fiber/cc.

B. If airborne fiber counts exceed 2.0 fibers per cubic centimeter for any period of time cease all work until fiber counts fall below 0.5 fibers per cubic centimeter and notify Owner's Representative. Do not recommence work until clean up is completed, new procedures are established, and fiber counts are less than 0.1 fiber/cc.

C. Outside Work Area: If any air samples taken outside of the work area exceeds the base line established below, immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area immediately erect new critical barriers as set forth in Section A01526 "Temporary Enclosures" to isolate the affected area from the balance of the building. Erect Critical Barriers at the next structural isolation of the involved space (e.g. wall, ceiling, and floor).

D. Respiratory protection as set forth in Section A01562 "Respiratory Protection" shall be worn in affected area until area is cleared for reoccupancy in accordance with Section A01714 "Work Area Clearance".

E. Leave Critical Barriers in place until completion of Work and insure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.

F. If the exit from the clean room of the personnel decontamination unit enters the affected area, establish a temporary decontamination facility consisting of a Shower Room and Changing Room as set forth in Section A01563 "Decontamination Units." After cleaning and decontamination of the affected area remove the Shower Room and leave the Changing Room in place as an air lock.

G. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area as set forth in the Section A01714 “Work Area Clearance.”

H. Fibers Counted: The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the NIOSH PCAM 239 or 7400 Procedures. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Owner for analysis by electron microscopy. "Airborne Fibers" counted in samples analyzed by Scanning or Transmission Electron microscopy shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by electron microscopy the number of "Airborne Fibers" shall be determined by multiplying the number of fibers, regardless of composition counted by the NIOSH PCAM 239 procedure, by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.

I. Effect on Contract Sum: If Electron Microscopy is used to arrive at the basis for determining "Airborne Fiber" counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken exceeds 0.5 fibers per cubic centimeter, or if any one sample exceeds 2.0 fibers per cubic centimeter, then the cost of such analysis will be born by the Contractor, at no additional cost to the Owner.

1.5 ANALYTICAL METHODS

A. The following methods will be used by the Owner in analyzing filters used to collect air samples.

1. Phase Contrast Microscopy (PCM): Fibers on each filter will be measured using NIOSH 7400 procedures carried out on the job site.
2. Cellulose Tester Filters will be analyzed using (Phase Contrast Microscope) NIOSH 7400. This analysis will be carried out at a laboratory located off the job site.
3. Polycarbonate filters will be analyzed using the National Asbestos Council Transmission Electron Microscopy protocol for "Clearance Monitoring."
4. Transmission Electron Microscopy (TEM): Asbestos structure on each filter will be measured using analysis as set forth in AHERA regulations, Appendix A to Subpart E of 40 CFR 763, October 30, 1987.

1.6 SAMPLE VOLUMES

A. General: The number and volume of air samples taken by the Owner will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical method used.

1.7 SCHEDULE OF AIR SAMPLES

A. Before Start of Work: The Owner will secure the following Air Samples to establish a base line before start of work:

Location Sampled	Number of Samples	Filter Media	Detection Limit Fibers/cc.	Minimum Volume (Litres)	Rate LPM
Ea. Work Area	1	Cellulose Ester	0.01	3000	2-12
Ea. Work Area	1	Polycarbonate	0.005	3000	2-12
Outside Ea. Work Area	5	Cellulose Ester	0.01	3000	2-12
Outside Ea. Work Area	1	Polycarbonate	0.005	3000	2-12
Outside Building	5	Cellulose Ester	0.01	3000	2-12
Outside Building	1	Polycarbonate	0.005	3000	2-12

B. Base Line: Is an action level expressed in fibers per cubic centimeter which is ten percent greater than the largest of the following:

1. Average of the samples collected on cellulose ester filters outside each work area.
2. Average of the samples collected on cellulose ester filters outside the building.
3. Samples collected on polycarbonate filters will be held without analysis. These samples will be analyzed under the conditions and terms set forth in "Fibers Counted" and "Affect on Contract Sum."

C. Daily: From start of work of Section A01526 "Temporary Enclosures" through the work of Section A01711 "Project Decontamination, the Owner will take the following samples on a daily basis:

Location Sampled	Number of Samples	Filter Media	Detection Limit Fibers/cc.	Minimum Volume (Liters)	Rate LPM
Ea. Work Area	1	Cellulose Ester	0.01	600	2-12
Outside Ea. Work Area	1	Cellulose Ester	0.01	3000	2-12
Outside Building	1	Cellulose Ester	0.01	3000	2-12
Outside Negative	1	Cellulose Ester	0.01	3000	2-12

Pressure System

D. If airborne fiber counts exceed allowed limits, additional samples will be taken as necessary to monitor fiber levels. If airborne fiber counts routinely exceed allowable limits a fibrous aerosol monitor will be used to monitor fiber levels.

1.8 LABORATORY TESTING

A. The services of a testing laboratory will be employed by the Owner to secure and perform laboratory analysis of the air samples. A microscope and technician will be set up at the job site, or samples will be sent daily by overnight mail, so that verbal reports on air samples can be obtained within 24 hours. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Owner's Representative, the Owner and the Contractor.

B. Written Reports of all air monitoring tests will be posted at the job site on a daily basis.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 The Contractor may conduct his own air monitoring and laboratory testing. If he elects to do this the cost of such air monitoring and laboratory testing shall be included in the Contract Sum.

END OF SECTION

SECTION A01503 - TEMPORARY FACILITIES - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF REQUIREMENTS

A. General: Provide temporary connection to existing building utilities or provide temporary facilities as required herein or as necessary to carry out the Work.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. General: Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

2.2 SCAFFOLDING

A. Provide all scaffolding, ladders and/or staging, etc., as necessary to accomplish the work of this contract. Scaffolding may be of suspension type, or standing type, such as metal tube and coupler, tubular welded frame, pole or outrigger type of cantilever type. The type, erection and use of all scaffolding shall comply with all applicable OSHA provisions.

B. Equip rungs of all metal ladders, etc. with an abrasive non-slip surface.

C. Provide a non-skid surface on all scaffold surfaces subject to foot traffic.

2.3 WATER SERVICE

A. Temporary Water Service Connection: All connections to the Owner's water system shall include backflow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.

B. Water Hoses: Employ heavy-duty abrasion-resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water into each work area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment.

C. Hot Water Heater: Provide UL rated 40 gallon electric hot water heater to supply hot water for the Decontamination Unit shower. Activate from 30 amp circuit breaker located within the Decontamination Unit subpanel. Provide with relief valve compatible with water heater operation; pipe relief valve down to drip pan on floor with Type L copper. Drip pans shall consist of a 12 inch square by 6 inch deep pan, made of 19 gauge galvanized steel, with handles. A 3-quart kitchen saucepan may be substituted for this purpose. Drip pan

shall be securely fastened to the hot water heater with bailing wire or similar material. Wiring of the hot water heater shall be in compliance with NEMA, NECA, and UL standards.

2.4 ELECTRICAL SERVICE

A. General: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.

B. Temporary Power: Provide service to Decontamination Unit subpanel with minimum 60 amp, 2 pole circuit breaker or fused disconnect connected to the building's main distribution panel. Subpanel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the Work. All temporary power to the work area must be brought in from outside the area through a ground-fault interrupter at the source.

C. Voltage Differences: Provide identification warning signs on power outlets which are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets. Dry type transformers shall be provided where required to provide voltages necessary for work operations.

D. Ground Fault Protection: Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.

E. Electrical Power Cords: Use only grounded extension cords; use "hard service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.

F. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage indicated or required for adequate illumination. Protect lamps with guard cages or tempered glass enclosures where fixtures are exposed to breakage by construction operations. Provide exterior fixtures where fixtures are exposed to the weather or moisture.

2.5 FIRST AID

A. First Aid Supplies: Comply with governing regulations and recognized recommendations within the construction industry.

2.6 FIRE EXTINGUISHERS

A. Fire Extinguishers: Provide Class A fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable- liquid fires. In other locations provide Class ABC dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

PART 3 - EXECUTION

3.1 SCAFFOLDING

A. During the erection and/or moving of scaffolding, care must be exercised so that the polyethylene floor covering is not damaged.

B. Clean debris as necessary from non-slip surfaces.

C. At the completion of abatement work, clean all construction aids within the work area, wrap in one layer of 6 mil polyethylene sheet and seal before removal from the work area.

3.2 INSTALLATION, GENERAL

A. General: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the work.

B. Relocate, modify and extend services and facilities as required during the course of work as to accommodate the entire work of the project.

3.3 WATER SERVICE

A. General: Water connection (without charge) to Owner's existing potable water system is limited to one 3/4 inch pipe-size connection, and a maximum flow of 10 gpm each to hot and cold water supply. Supply hot and cold water to the Decontamination Unit in accordance with Section A01563.

B. Maintain hose connections and outlet valves in leakproof condition. Where finish work below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize the possibility of water damage. Drain water promptly from pans as it accumulates.

3.4 ELECTRICAL SERVICE

A. General: Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.

B. Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead, and rise vertically where wiring will be least exposed to damage from construction operations.

C. Temporary Wiring: In the work area shall be Type UF non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.

D. Provide overload-protected disconnect switch for each temporary circuit located at the power distribution center.

E. For power hand tools and task lighting, provide a temporary 4-gang outlet at each decontamination unit, located in equipment room. Provide a separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).

3.5 TEMPORARY LIGHTING

A. Provide the following where natural lighting or existing building lighting does not meet the required light level:

1. One 200-watt incandescent lamp per 1000 square feet of floor area, uniformly distributed, for general construction lighting, or equivalent illumination of a similar nature. In corridors and similar traffic areas provide one 100-watt incandescent lamp

every 50 feet. In stairways and at ladder runs, provide one lamp minimum per story, located to illuminate each landing and flight. Provide sufficient temporary lighting to ensure proper workmanship everywhere by combined use of daylight, general lighting, and portable plug-in task lighting.

2. Provide lighting in the Decontamination Unit as required supply a 50 foot candle minimum light level.

3.6 TEMPORARY HEAT

A. General: Provide temporary heat where indicated or needed for performance of the work.

B. Maintain a minimum temperature of 70 deg F where finished work has been installed.

C. Maintain a minimum temperature of 75 deg F in the shower of the decontamination unit.

D. Maintain a minimum temperature of 70 deg F in work areas at all times where work is taking place. At all other times and at completion of removal work, but before start of reconstruction work, maintain a minimum temperature of 50 deg F.

3.7 SANITARY FACILITIES

A. Toilets: To avoid excessive travel in and out of the work area, provide one self-contained chemical toilet unit in the work area for each 30 workers. Facilities shall be maintained throughout the Work. At the end of the job, facilities shall be decontaminated in accordance with these specifications.

3.8 FIRE EXTINGUISHERS

A. Fire Extinguishers: Comply with the applicable recommendations of NFPA 10 "Standard for Portable Fire Extinguishers." Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher in each Work Area in Equipment Room and one outside Work Area in Clean Room.

END OF SECTION

SECTION A01513 - NEGATIVE PRESSURE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Before Start of Work submit design of negative air system to the Owner's Representative for review. Do not begin work until submittal is returned with the Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use. Include the following in the submittal at a minimum:

1. Number of negative air machines required and the calculations necessary to determine the number of machines.
2. Description of projected air flow within work area and methods required to provide adequate air flow in all portions of the work area.
3. Pressure differential across work area enclosures anticipated.
4. Description of methods of testing for correct airflow and pressure differentials.
5. Manufacturer's product data on the machines to be used.
6. Location of the machines in the work space.
7. Method of supplying adequate power to the machines and designation of building electrical panel(s) which will be supplying the power.
8. Description of work practices to insure that airborne fibers travel downstream from workers.
9. Manufacturer's product data on equipment to monitor pressure differential between inside and outside of work area.
10. Manufacturer's product data on auxiliary generator to be used.
11. Manufacturer's product data on auxiliary power switch to be used.
12. Schematic diagram of power and auxiliary power supply to negative air machines.

1.3 QUALITY ASSURANCE

A. Monitor pressure differential across Decontamination Unit with a differential pressure meter equipped with a strip chart recorder. Meter shall be equipped with a warning buzzer which will sound if pressure differential drops below 0.01 inches of water.

PART 2 - PRODUCTS

2.1 NEGATIVE AIR MACHINES

A. General: Supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:

1. Cabinet: Constructed of steel or other durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. Cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end. Unit shall be mounted on casters or wheels.

B. Fans: Rate capacity of fan according to usable air-moving capacity under actual operating conditions. Use centrifugal-type fan.

C. HEPA Filters: The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame.

1. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal.
2. Each filter shall be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 um diotylphthalate (DOP) particles. Testing shall be in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A. Each filter shall bear a UL586 label to indicate ability to perform under specified conditions.
3. Each filter shall be marked with: the name of manufacturer, serial number, air flow rating, efficiency and resistance, and direction of test air flow.

D. Prefilters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of prefiltration are required. The first-stage prefilter shall be a low-efficiency type (e.g. for particles 10 um and larger). The second stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 um). Prefilters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.

E. Instrumentation: Each unit shall be equipped with a Magnehelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the usable air-handling capacity for various static pressure readings on the Magnehelic gauge shall be affixed near the gauge for reference, or the Magnehelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.

F. Safety and Warning Devices: The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge. Warning lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge).

G. Electrical components shall be approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.

H. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Aerospace America, Inc., Truman Parkway, Box 189, Bay City, Michigan 48707; "Aero-Clean 2000."
2. Asbestos Control Technology, Inc., Box 183, Maple Shade, N.J. 08052; "Micro-Trap."
3. Control Resource Systems Inc., Mariner Drive, Michigan City, Indiana 46360; "Hog 2000."
4. Global Consumer Services Inc., N. Highland Avenue, Los Angeles, CA 90028; "Red Baron."
5. Trim-Dim Filter Corp., West Lake St., Chicago, Illinois 60607; "ACCU-2M."

PART 3 - EXECUTION

3.1 PRESSURE DIFFERENTIAL

A. Provide a fully operational negative air system within the work area maintaining continuously a pressure differential across work area enclosures of 0.01 inches of water. Demonstrate to the Owner's Representative the pressure differential by use of a pressure differential meter or a manometer, before disturbance of any asbestos containing materials.

3.2 MONITORING

A. Continuously monitor and record the pressure differential between the work area and the building outside of the work area with a monitoring device incorporating a strip chart recorder.

3.3 PREPARATION OF THE WORK AREA

A. Determining the Ventilation Requirements: Provide fully operational negative pressure systems supplying a minimum of one air change every 15 minutes. Determine the volume in cubic feet of the work area by multiplying floor area by ceiling height. Determine total ventilation requirement in cubic feet per minute (cfm) for the work area by dividing this volume by the air change rate.

B. Ventilation Required (CFM) = Volume of work area (cu. ft.)/15 min.

C. Determine Number of Units needed to achieve 15 minute change rate by dividing the ventilation requirement (CFM) above by capacity of exhaust unit(s) used. Capacity of a unit for purposes of this section is the capacity in cubic feet per minute with fully loaded filters (pressure differential which causes loaded filter warning light to come on) in the machines labeled operating characteristics.

D. Add one (1) additional unit as a backup in case of equipment failure or machine shutdown for filter changing.

E. Location of Exhaust Units: Locate exhaust unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses work area as much as possible. This may be accomplished by positioning the exhaust unit(s) at a maximum distance from the work access opening or other makeup air sources.

F. Place End of Unit or its exhaust duct through an opening in the plastic barrier or wall covering. The plastic around the unit or duct shall then be sealed with tape.

G. Vent to Outside of Building, unless authorized in writing by the Owner's Representative.

H. Supplemental Makeup Air Inlets: Provide where required for proper air flow through the work space in location approved by the Owner's Representative by making openings in the plastic sheeting that allow air from outside the building into the work area. Locate auxiliary makeup air inlets as far as possible from the exhaust unit(s) (e.g., on an opposite wall), off the floor (preferably near the ceiling), and away from barriers that separate the work area from occupied clean areas. Cover with flaps to reseal automatically if the negative pressure system should shut down for any reason. Spray flap and around opening with spray adhesive so that flap seals if it closes.

3.4 USE OF THE NEGATIVE PRESSURE SYSTEM

A. General: Each unit shall be serviced by a dedicated minimum 115V-20A circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all negative pressure units connected. Dedication of an existing circuit may be accomplished by shutting down existing loads on the circuit.

B. Testing the System: Test negative pressure system before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of negative pressure system to Owner's Representative.

C. Demonstrate Operation of the negative pressure system to the Owner's Representative will include, but not limited to, the following:

1. Plastic barriers and sheeting move lightly in toward work area.
2. Curtain of decontamination units move lightly in toward work area.
3. There is a noticeable movement of air through the decontamination unit. Use smoke tube to demonstrate air movement from Clean Room to Shower Room, from Shower Room to Equipment Room, and from Equipment Room to Work Area.
4. Use smoke tubes to demonstrate a positive motion of air across all area in which work is to be performed.
5. Use a differential pressure meter or manometer to demonstrate a pressure difference of at least 0.01 inches of water across every barrier separating the Work Area from the balance of the building or outside.
6. Modify the Negative Pressure System as necessary to successfully demonstrate the above.

D. Use of System During Abatement Operations:

1. Start exhaust units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain a constant negative pressure until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.
2. Do not shut down negative air system during encapsulating procedures, unless authorized by the Owner's Representative in writing.
3. Start abatement work at a location farthest from the exhaust units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and exhaust units are operating again.

E. At completion of abatement work, allow exhaust units to run as specified under Section A01711 “Project Decontamination,” to remove airborne fibers that may have been generated during abatement work and cleanup, and to purge the work area with clean makeup air. The units may be required to run for a longer time after decontamination if dry or only partially wetted asbestos material was encountered during any abatement work.

F. Dismantling the System: When a final inspection and the results of final air tests indicate that the area has been decontaminated, exhaust units may be removed from the work area. Before removal from the work area, remove and properly dispose of pre-filter, and seal intake to the machine with 6 mil polyethylene to prevent environmental contamination from the filters.

END OF SECTION

SECTION A01526 - TEMPORARY ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Submit Contingency Plans for safe evacuation of the work area in case of fire or injury.

1.3 SAFETY

A. Contact fire control agencies to review procedures prior to start of work.

PART 2 - PRODUCTS

2.1 POLYETHYLENE SHEET

A. Provide flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.2 REINFORCED POLYETHYLENE SHEET

A. Where plastic sheet is the only separation between the work area and building exterior, provide translucent, nylon reinforced, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 70, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.3 SPRAY PLASTIC

A. Provide spray plastic in aerosol cans or premixed for spray application which is formulated to adhere gently to surfaces and remove cleanly by peeling off at the completion of the work.

2.4 DUCT TAPE

A. Provide duct tape in 2 or 3 inch widths as indicated, with an adhesive which is formulated to aggressively stick to sheet polyethylene.

2.5 SPRAY CEMENT

A. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

PART 3 - EXECUTION

3.1 SEQUENCE OF WORK

A. Carry out work of this section sequentially. Complete each activity before proceeding to the next.

3.2 GENERAL

A. Work Area: Is the location where asbestos abatement work occurs. It is a variable of the extent of work of the contract. It may be a portion of a room, a single room, or a complex of rooms. A "Work Area" is considered contaminated during the work, and must be isolated from the balance of the building and decontaminated at the completion of the asbestos control work.

B. Completely isolate the work area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the work area (s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Section A01711. Perform all such required cleaning or decontamination at no additional cost to Owner.

C. Place all tools, scaffolding, staging, etc., necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.

D. Remove all uncontaminated removable furniture, equipment, and/or supplies from the work area before commencing work, or completely cover with two (2) layers of polyethylene sheeting, at least 6 mil in thickness, securely taped in place with duct tape. Such furniture and equipment shall be considered outside the work area unless covering plastic or seal is broached.

E. Disable ventilating systems or any other system bringing air into or out of the work area. Disable system by disconnecting wires, removing circuit breakers, by lockable switch or other positive means that will prevent accidental premature restarting of equipment.

F. Lockout power to work area by switching off all breakers serving power or lighting circuits in work area. Label breakers with tape over breaker with notation "DANGER circuit being worked on". Lock panel and have all keys under control of contractor's superintendent or Owner's designated representative.

G. Lockout power to circuits running through work area wherever possible by switching off all breakers serving these circuits. Label breakers with tape over breaker with notation "DANGER circuit being worked on". Lock panel and have all keys under control of contractor's superintendent or Owner's designated representative. All power running through work area must be shut down.

3.3 CONTROL ACCESS

A. Permit access to the work area only through the Decontamination Unit. All other means of access shall be closed off and sealed and warning signs displayed on the clean side of the sealed access.

B. Visual Barrier: Where the work area is immediately adjacent to or within view of occupied areas, provide a visual barrier or opaque polyethylene sheeting at least 6 mil in thickness

so that the work procedures are not visible to building occupants. Where this visual barrier would block natural light, substitute frosted sheet plastic in locations approved by the Owner's Representative.

C. Physical Barrier: Where the area adjacent to the work area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with nominal 2 by 4 wood metal studs 16 inches on center, securely anchored to prevent movement, covered with minimum 1/4 inch thick hardboard, 1/2 inch gypsum wall board, or 1/2 inch plywood.

D. Provide Warning Signs at each visual and physical barriers reading as follows in both English and Spanish:

Legend	Notation
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK IN PROGRESS	1" Sans Serif Gothic or Block
BREATHING ASBESTOS DUST MAY BE HAZARDOUS TO YOUR HEALTH	14 Point Gothic

3.4 RESPIRATORY AND WORKER PROTECTION

A. Before proceeding beyond this point in providing Temporary Enclosures:

1. Provide Respiratory Protection per Section A01562.
2. Provide Worker Protection per Section A01560.

3.5 CRITICAL BARRIERS

A. Completely separate the work area from other portions of the building, and the outside by sheet plastic barriers at least two layers 6 mil in thickness, or by sealing with duct tape.

B. Individually seal ALL ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other opening into the work area with duct tape alone or with polyethylene sheeting at least 6 mil in thickness, taped securely in place with duct tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing off lighting fixtures to avoid melting or burning of sheeting.

C. Provide Sheet Plastic barriers at least 6 mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape or spray cement.

D. Mechanically support sheet plastic independently if duct tape or spray cement seals so that seals do not support the weight of the plastic Following are acceptable methods of supporting sheet plastic barriers. Alternative support methods may be used if approved in writing by the Owner's Representative.

E. Provide Decontamination Units per Section A01563.

F. Provide Negative Pressure System per Section A01513.

G. Clean housings and ducts of all overspray materials prior to erection of the Critical Barrier Polyethylene sheeting.

3.6 PRIMARY BARRIER

A. Clean all contaminated furniture, equipment, or supplies with a HEPA filtered vacuum cleaner or by wet cleaning prior to being moved or covered. All equipment, furniture, etc., is to be deemed contaminated unless specifically declared as uncontaminated on the drawings or in writing by the Owner's Representative.

B. Clean all surfaces in work area with a HEPA filtered vacuum or by wet wiping prior to the installation of any sheet plastic.

C. Enclose work areas with one (1) layer of reinforced plastic sheeting and two (2) layers of plastic sheeting on floor and one (1) layer on walls, or as otherwise directed on the contract drawings or in writing by the Owner's Representative.

D. Cover floor of work area with 2 individual layers of clear polyethylene sheeting, each at least 6 mil in thickness, turned up walls at least 12 inches. Form a sharp right angle bend at junction of floor and wall so that there is no radius which could be stepped on causing the wall attachment to be pulled loose. Both spray-glue and duct tape all seams in floor covering. Locate seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.

E. Cover Sheet Plastic in areas where scaffolding is to be used with a single layer of 1/2 inch CDX plywood or 1/4 inch tempered hardboard. Wrap edges and corners of each sheet with duct tape. At completion of abatement work wrap plywood or hardboard with 2 layers of 6 mil polyethylene and move to next work area or dispose of as an asbestos contaminated waste material in accordance with Section A02084 of this Specification.

F. Remove all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc., which cover any part of the surface to be worked on with the work.

G. Remove all general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover any part of the surface to be worked on with the work.

H. Cover all walls in work area including "Critical Barrier" sheet plastic barriers with one layer of polyethylene sheeting, at least 6 mil in thickness, mechanically supported and sealed with duct tape or spray-glue in the same manner as "Critical Barrier" sheet plastic barriers. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated on the contract documents or in writing by the Owner's Representative.

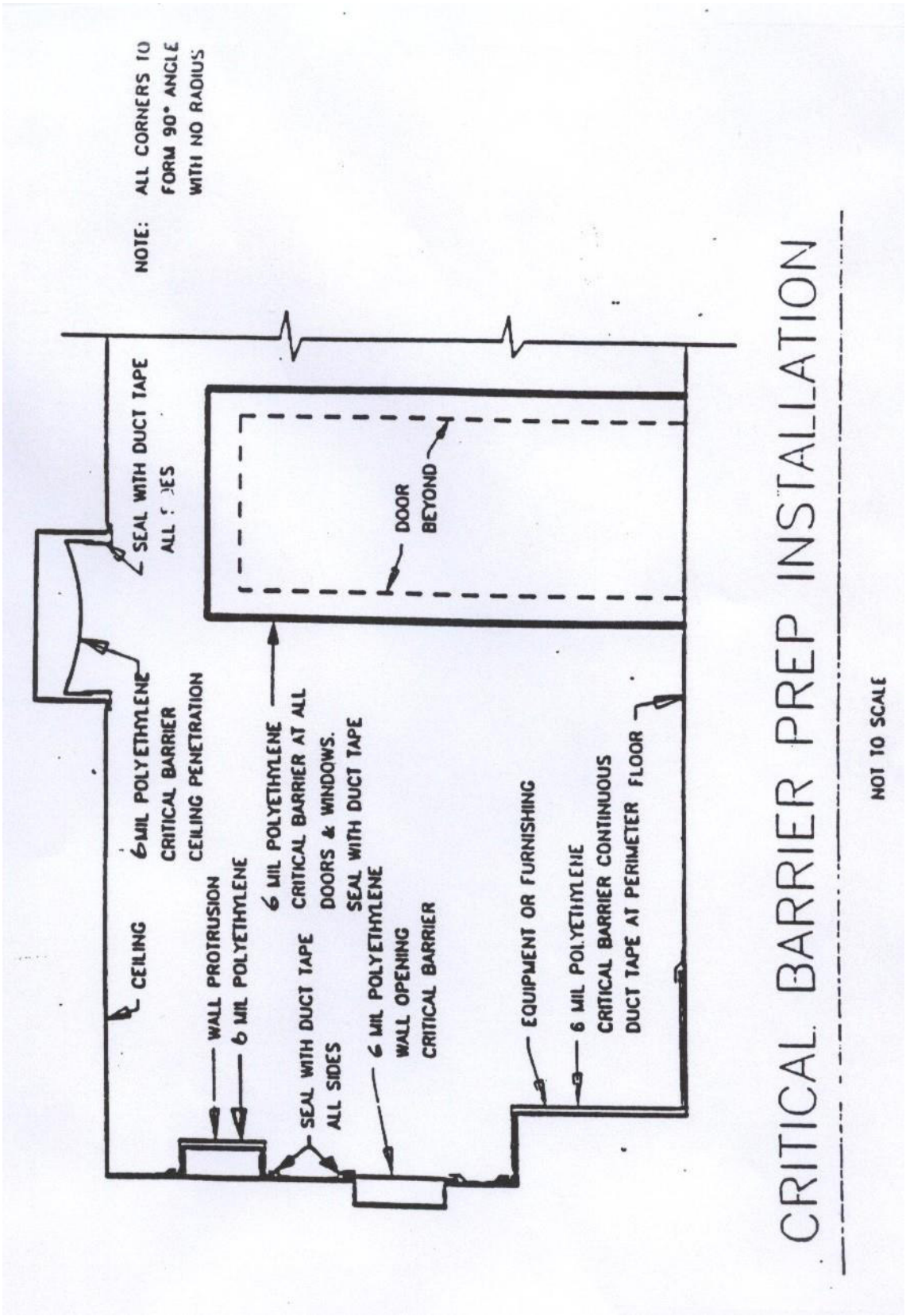
I. Stair and Ramps: Do not cover stairs or ramps with unsecured sheet plastic. Where stairs or ramps are covered with plastic, provide 3/4 inch exterior grade plywood treads securely held in place, over plastic. Do not cover rungs or rails with any type of protective materials.

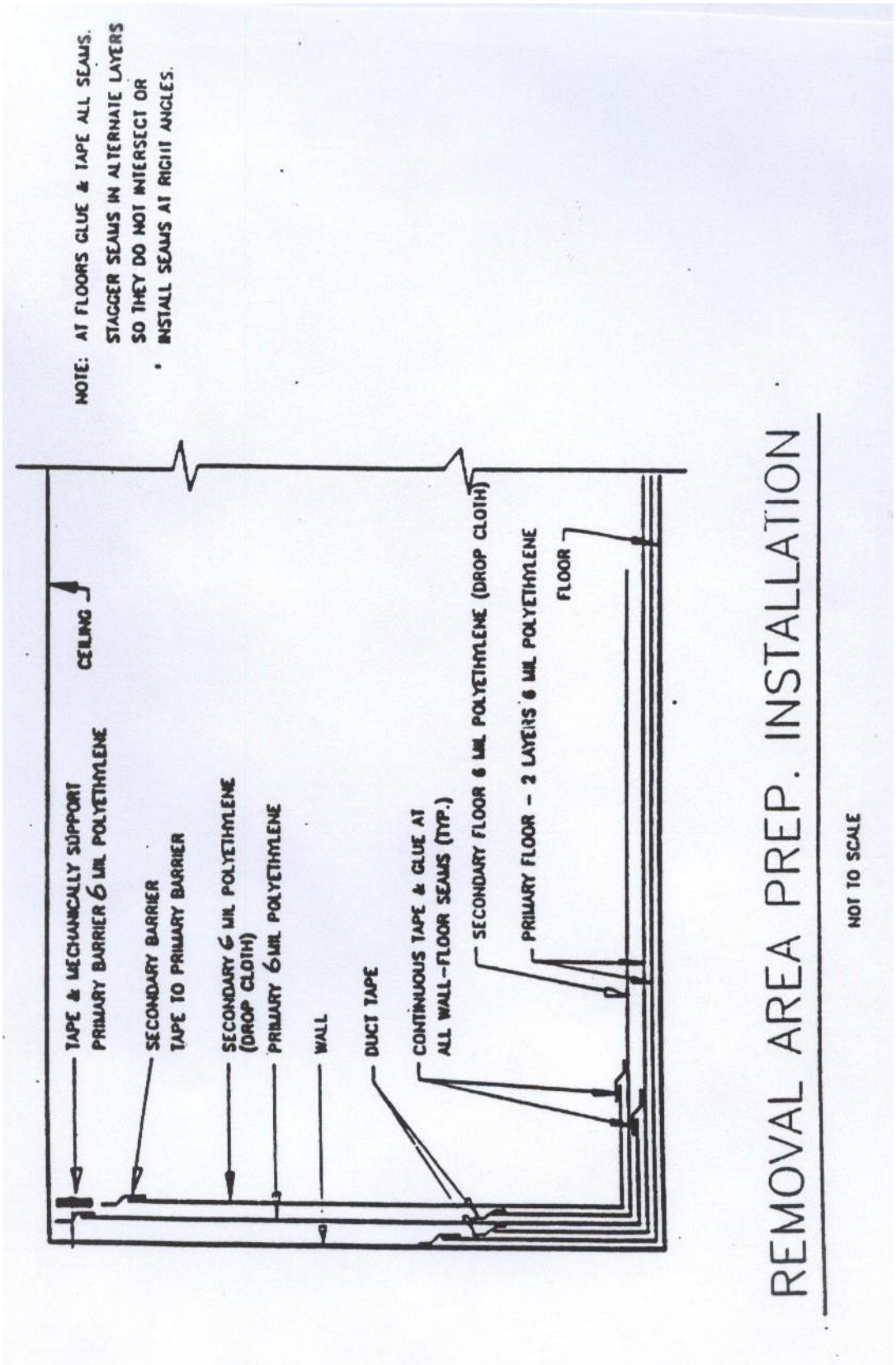
3.7 EXTENSION OF WORK AREA

A. Extension of Work Area: If the enclosure barrier is breeched in any manner that could allow the passage of asbestos debris or airborne fibers, then add affected area to the work area, enclose it as required by this Section of the Specification and decontaminate it as described in Section A01711.

3.8 SECONDARY BARRIER

A. Secondary layers of plastic to protect the primary layer from debris generated by the asbestos abatement work shall be provided as indicated on the following drawings.


NOTE: ALL CORNERS TO FORM 90° ANGLE WITH NO RADIUS
SEAL WITH DUCT TAPE ALL SIDES
DOOR BEYOND
6 MIL POLYETHYLENE CRITICAL BARRIER CEILING PENETRATION
CEILING
WALL PROTRUSION
6 MIL POLYETHYLENE
SEAL WITH DUCT TAPE ALL SIDES
6 MIL POLYETHYLENE CRITICAL BARRIER AT ALL DOORS & WINDOWS.
SEAL WITH DUCT TAPE
6 MIL POLYETHYLENE WALL OPENING CRITICAL BARRIER
EQUIPMENT OR FURNISHING
6 MIL POLYETHYLENE CRITICAL BARRIER CONTINUOUS DUCT TAPE AT PERIMETER FLOOR
CRITICAL BARRIER PREP INSTALLATION
NOT TO SCALE



END OF SECTION

SECTION A01560 - WORKER PROTECTION - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section A01562 "Respiratory Protection."

1.2 SUMMARY

A. Section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

1.3 WORKER TRAINING

A. Train, in accordance with 29 CFR 1926, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in the course to the following:

1. Methods of recognizing asbestos
2. Health effects associated with asbestos.
3. Relationship between smoking and asbestos in producing lung cancer.
4. Nature of operations that could result in exposure to asbestos.
5. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

a. Engineering controls.
b. Work practices.
c. Respirators.
d. Housekeeping procedures.
e. Hygiene Facilities.
f. Protective clothing.
g. Decontamination procedures.
h. Emergency procedures.
i. Waste disposal procedures.
j. Purpose, proper use, fitting, instructions, and limitations of respirators as required by 29 CFR
k. Appropriate work practices for the work.
l. Requirements of medical surveillance program.
m. Review of 29 CFR 1926.
n. Negative air systems.
o. Work practices including hands on or on-job training.
p. Personal decontamination procedures.
q. Air monitoring, personal and area.

1.4 MEDICAL EXAMINATIONS

A. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific

airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall as a minimum meet OSHA requirements as set forth in 29 CFR 1926. In addition, provide an evaluation of the individuals ability to work in environments capable of producing heat stress in the worker.

1.5 SUBMITTALS

A. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use.

B. Certificate Worker Acknowledgment: Submit an original signed copy of the Certificate of Worker's Acknowledgment found at the end of this section, for each worker who is to be at the job or enter the work area.

C. Training Program: Submit a course outline of the worker training course. Include date and time course was given, name and title of teacher, attendance sheet listing all attendees of the course. Submittal shall be in the form of a letter signed and dated by the course teacher.

D. Report from Medical Examination: Conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the work area.

E. Submit, at a minimum for each worker, the following:

1. Name and Social Security Number.
2. Physicians Written Opinion, from examining physician, including at a minimum the following:

    a. Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos.
    b. Any recommended limitation on the worker or on the use of personal protective equipment such as respirators.
    c. Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.
    d. Copy of information that was provided to physician in compliance with 29 CFR 1926.
    e. Statement that worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing heat stress in the worker.

F. Notarized Certifications: Submit certificate signed by an officer of the abatement contracting firm and notarized that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.

G. Asbestos Worker Accreditation: Submit copies of Asbestos Abatement Worker certificates required by the AHERA Regulations as outlined in the Federal Register of April 30, 1987, Appendix C to Subpart E, 40 CFR 763.

H. Asbestos Handler Licenses: Submit all licenses required by New York State Department of Labor, Industrial Code Rule 56.

PART 2 - EQUIPMENT

2.1 PROTECTIVE CLOTHING

A. Coveralls: Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the work area. Provide a sufficient number of all required changed, for all workers in the work area.

B. Boots: Provide work boots with non-skid soles, and where required by OSHA, foot protectives, for all workers. Provide boots at no cost to workers. Paint uppers of all boots red with water proof enamel. Do not allow boots to be removed from the work area for any reason, after being contaminated with asbestos containing material. Dispose boots as asbestos contaminated waste at the end of the work.

C. Hard Hats: Provide head protectives (hard hats) as required by OSHA for all workers, and provide 4 spares for use by Owner's Representative, Project Administrator, and Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of type with plastic strap type suspension. Require hats to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.

D. Goggles: Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.

E. Gloves: Provide work gloves to all workers and require that they be worn at all times in the work area. Do not remove gloves from work area and dispose of as asbestos contaminated waste at the end of the work.

2.2 ADDITIONAL PROTECTIVE EQUIPMENT

A. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Owner, Owner's Representative, Project Administrator, and other authorized representatives who may inspect the job site. Provide two (2) respirators and six (6) complete coveralls and, where applicable, six (6) respirator filter changes per day.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.

B. Each time work area is entered, remove all street clothes in the Changing Room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

3.2 DECONTAMINATION PROCEDURES

A. Require all workers to adhere to the following personal decontamination procedures whenever they leave the work area:

B. Type C Supplied Air or Powered Air-Purifying Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area:

1. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers and boots in the equipment room.
2. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:

    a. Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR) hold blower unit above head to keep canisters dry.
    b. With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.
    c. Take a deep breath, hold it and/or exhale slowly, completely wet hair, face and respirator. While still holding breath, remove respirator and hold it away from face before starting the breath.
    d. Carefully wash face piece of respirator inside and out.

3. If using PAPR: shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.

    a. Shower completely with soap and water.
    b. Rinse thoroughly.
    c. Rinse shower room walls and floor prior to exit.
    d. Proceed from shower to Changing Room and change into street clothes or into new disposable work items.

C. Air Purifying-Negative Pressure Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator.

1. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.

    a. Still wearing respirators, proceed to showers, Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filers to avoid asbestos fibers while showering. The following procedure is required as a minimum:
    b. Thoroughly wet body from neck down.
    c. Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.
    d. Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.
    e. Dispose of wet filters from air purifying respirator.
    f. Carefully wash face piece of respirator inside and out.
    g. Shower completely with soap and water.

h. Rinse thoroughly.
i. Rinse shower room walls and floor prior to exit.
j. Proceed from shower to Changing Room and change into street clothes or into new disposable work items.

3.3 WITHIN WORK AREA

A. Require that workers NOT eat, drink, smoke, or chew gum or tobacco in the work area. To eat, chew, drink, or smoke, workers shall follow the procedure described above, then dress in street clothes before entering the non-work areas of the building.

3.4 CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

A. Following this section is a Certificate of Worker Training. After each worker has been included in the Contractor's Respiratory Protection Program, completed training program, and medical examination, secure a fully executed copy of this form.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME_____DATE_____

PROJECT ADDRESS_____
CONTRACTORS' NAME_____

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators, and informed of the type of respirator to be used on the above referenced project. I have a copy of the written respiratory protection manual issued by my employer. I have been equipped at no cost with the respirator to be used on the project.

TRAINING COURSE: I have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course included the following:

Physical characteristics of asbestos
Health hazards associated with asbestos
Respiratory protection
Use of protective equipment
Negative air systems
Work practices including hands on or on-job training
Personal decontamination procedures
Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

Signature_____

Printed Name_____

Social Security Number_____

Witness_____

END OF SECTION

SECTION A01562 - RESPIRATORY PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. Instruct and train each worker involved in asbestos abatement or maintenance and repair of friable asbestos containing materials in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos fibers until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.

1.3 STANDARDS

A. Except to the extent that more stringent requirements are written directly into the Contract Documents, the following regulations and standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards, meet the more stringent requirement.

1. OSHA U.S. Department of Labor Occupational Safety and Health Administration, Safety and Health Standards 29 CFR 1910, Section 10001 and Section 1910.134, 29 CFR 1926.
2. CGA Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air For Human Respiration", and Specification G-7.1 "Commodity Specification for Air."
3. CSA Canadian Standard Association, Rexdal, Ontario, Standard Z180.1-1978, "Compressed Breathing Air".
4. ANSI American National Standard Practices for Respiratory Protection, ANSI Z88.1-1980.
5. NIOSH National Institute for Occupational Safety and Health.
6. MSHA Mine Safety and Health Administration.

1.4 SUBMITTALS

A. Before Start of Work submit the following to the Owner's representative for review. Do not begin work until these submittals are returned with the Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use.

B. Product Data: Submit manufacturer's product information for each component used, including NIOSH and MSHA Certifications for each component in an assembly and/or for entire assembly.

C. System Diagram: When a Type "C" supplied air respiratory system is required by the work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in work area(s), routing of air lines to work(s), routing of air lines to work area(s) from compressor.

D. Operating Instruction: Submit complete operating and maintenance instructions for all components and systems as a whole. Submittal is to be in bound manual form suitable for field use.

E. Respiratory Protection Program: Submit level of respiratory protection intended for each operation required by the project. Submit this information on the "Respiratory Protection Program" form at the end of this section.

F. Historic Airborne Fiber Data: Submit airborne asbestos fiber count data from three previous projects of similar size and scope by an independent air monitoring firm to substantiate selection of respiratory protection proposed. Data submitted shall include at least the following for each procedure required by the work:

1. Date of measurements.

a. Operation monitored.
b. Sampling and analytical methods used and evidence of their accuracy.

2. Number, duration, and results of samples taken.

G. Resume Information: Submit resume and information on training for individual monitoring the operation of supplied air respiratory systems. Submit training certifications where applicable.

1.5 AIR QUALITY FOR SUPPLIED AIR RESPIRATORY SYSTEMS

A. Provide air use for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. type 1 (Gaseous Air) Grade H or CSA Z180.1 whichever presents the more stringent quality standard:

1.6 ALLOWABLE CONTAMINANTS

A. The following table sets forth the quantity of any given contaminant allowed according to the referenced standards:

CONTAMINANT	Type 1 Grade D	CGA (Gaseous Air) Grade E	Grade H	CSA Z180.1
Carbon Monoxide, PPM/v	20	10	5	5
Carbon Dioxide,PPM/v	1000	500	500	500
Condensed Hydrocarbons mg./cu. meter	5	5		1
Gaseous Hydrocarbons as methane, PPM/v			10	25
Water Vapor-PPM/v	(1)	(1)	(1)	27
dewpoint	-50F	-50F	-50F	-63F
Objectionable Odors	None	None	None	None

Nitrogen Dioxide, PPM/v	-	-	0.5	0.2
Nitrous Oxide, PPM/v	-	-	-	5
Sulfur Dioxide, PPM/v	-	-	0.5	-
Halogenated Solvents,PPM/v	-	-	1	-
Other gaseous contaminates	-	-	-	(2)
Inorganic particulates, mg./cu. meter	-	-	-	1

- Indicates that the standard shows no limiting characteristics.

1. The CGA standards do not call out a specific moisture limit when the ambient temperature is above freezing. However, since a moisture content no greater than a -50 Degrees F. dewpoint (66) PPM/v) is necessary for carbon monoxide elimination, the CO limits could not be met unless the air were dried to a -50 Degrees F. dewpoint or better.
2. Maximum allowable content of trichlorotrifluorethane, dichlorodifluoromethane, and chlorodifluoromethane is 2PPM/v for each. Unlisted contaminants shall not exceed one-tenth of the Threshold Limit Values (TLV's) for Chemical Substances in Workroom air adopted by the American Conference of Governmental Industrial Hygienists (ACGIH).

1.7 DELIVERY

A. Deliver replacement parts, etc., not otherwise labeled by NIOSH or MSHA to job site in manufacturer's containers.

PART 2 - EQUIPMENT

2.1 AIR PURIFYING RESPIRATORS

A. Respirator Bodies: Provide half face or full face type respirators. Equip full face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.

B. Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.

C. Non-permitted respirators: Do not use single use, disposable or quarter face respirators.

2.2 SUPPLIED AIR RESPIRATOR SYSTEMS

A. Provide equipment capable of producing air of the quality and volume required by the above reference standards applied to the job site conditions and crew size. Comply with provisions of this specification, if more stringent than the governing standard.

B. Face Piece and Hose: Provide full face piece and hose by same manufacturer that has been certified by NIOSH/MSHA as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure face piece.

C. Auxiliary Back-up System: In atmospheres which contain sufficient oxygen (greater than or equal to 19.5% oxygen) provide a pressure-demand full face piece supplied air respirator equipped with an emergency back-up HEPA filter.

D. Escape Air Supply: In atmospheres which are oxygen deficient (less than 19.5% oxygen) provide a pressure-demand full face piece supplied air respirator incorporating an auxiliary self-contained breathing apparatus (SCBA) which automatically maintains an uninterrupted air supply in pressure demand mode with a positive pressure face piece.

E. Back-up Air Supply: Provide a reservoir of compressed air located outside the work area which will automatically maintain a continuous uninterrupted able source of air automatically available to each connected face piece and hose assembly in the event of compressor shut down, contamination of air delivered by compressor, power loss or other failure. Provide sufficient capacity in the back-up air supply to allow a minimum escape time of one-half hour times the number of connections available to the work area. Air requirements at each connection is the air requirement of the respirators in use plus the air requirement of an average sized adult male engaged in moderately strenuous activity.

F. Warning Device: Provide a warning device that will operate independently of the building's power supply. Locate so that alarm is clearly audible above the noise level produced by equipment and work procedures in use, in all parts of the Work area and at the compressor. Connect alarm to warn of:

1. Compressor shut down or other fault requiring use of backup air supply.
2. Carbon Monoxide (CO) levels in excess of 5 PPM/V.

G. Carbon Monoxide (CO) Monitor: Continuously monitor and record on a strip chart recorder Carbon Monoxide (CO) levels. Place monitors in the air line between compressor and back-up air supply and between back-up air supply and workers. Connect monitors so that they also sound an alarm as specified under "Warning Devices".

H. Compressor Shut Down: Interconnect monitors, alarms and compressor so that compressor is automatically shut down and the alarms sounded if any of the following occur:

1. Carbon Monoxide (CO) concentrations exceed 5 PPM/v in the air line between the filter bank and backup air supply.
2. Compressor temperature exceed normal operating range.

I. Compressor Motor: Provide a compressor driven by an electric motor. Do not use a gas or diesel engines to drive compressor. Insure that electrical supply available at the work site is adequate to energize motor.

J. Self-Contained Breathing Apparatus (SCBA): Configure system to permit the recharging of 1/2 hour 2260 PSI SCBA cylinders.

PART 3 - EXECUTION

3.1 GENERAL

A. Respiratory Protection Program: Comply with ANSI Z88.2 - 1980 "Practices for Respiratory Protection" and OSHA 29 CFR 1910 and 1926.

B. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.

C. Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy in accordance with Section A01714.

D. Regardless of Airborne Fiber Levels: Require that the minimum level of respiratory protection used be half-face powered air-purifying respirators with high efficiency filters during abatement and removal procedure.

E. Do not allow the use of single-use, disposable, or quarter-face respirators for any purpose.

3.2 FIT TESTING

A. Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training set up and administered by a Certified Industrial Hygienist. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which he has been trained and fit.

B. On a Weekly Basis: Check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube.

C. Upon Each Wearing: Require that each time an air-purifying respirator is put on, it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

3.3 TYPE OF RESPIRATORY PROTECTION REQUIRED

A. Provide Respiratory Protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed.

B. Type "C" Supplied-Air Respirators: Full face piece pressure demand supplied air respirators are to be used by all worker engaged in the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, or the removal or demolition of asbestos insulation or coverings, for any other activity which results in or may result in airborne asbestos fibers.

3.4 PERMISSIBLE EXPOSURE LIMIT (PEL)

A. 8-Hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed the following.

B. Fibers: For purposes of this section fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH P CAM 239 or 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.

C. Time Weighted Average (TWA) - 0.01 fibers/cubic centimeter.

3.5 AIR PURIFYING RESPIRATORS

A. Negative Pressure - Half or Full Face Mask: Supply a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.

B. Powered Air Purifying - Half or Full Face Mask: Supply a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decrease to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the work area. Caution should be used to avoid shorting battery pack during washing. Provide an extra battery pack for each respirator so that one can be charging while one is in use.

3.6 TYPE "C" RESPIRATOR

A. Air Systems Monitor: Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and all warning and monitoring devices at all times that system is in operation. Assign an individual trained, by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring. Assign no other duties to this individual which will take him away from monitoring the air system.

3.7 RESPIRATORY PROTECTION PROGRAM

A. Submit completed form "Respiratory Protection Program", found at end of this section, indicating type of respiratory protection proposed for each portion of the work.

RESPIRATORY PROTECTION PROGRAM:

Project Name _____

Location _____

Date _____

Based upon airborne asbestos-fiber counts encountered on previous projects of similar type working on materials similar to those found on the above referenced project. The following level of respiratory protection is proposed for the indicated operations to maintain an Airborne Fiber Count (as measured by P CAM 239 Method) below the specified Permissible Exposure Limit (PEL) inside the respirator face piece.

Operation	Anticipated f/cc	Respiratory Protection	Protection Factor	f/cc in Mask
Installing sheet plastic				
Removing trim in contact with asbestos-containing material				
Removal of Architectural finish or fireproofing				
Removal of pipe insulation				
Removal of fitting insulation				
Encapsulation of pipe boiler insulation				
Gross debris removal				

Operation	Anticipated f/cc	Respiratory Protection	Protection Factor	f/cc in Mask
Cleaning "primary" sheet plastic				
Cleaning "critical" barrier				
Removing decontamination unit				
Disposal at land fill				
Other				

The Contractor certified that to the best of his knowledge and belief the above represent a true and accurate representation of Airborne Fiber Counts to be expected for the operations indicated, and are based upon airborne fiber data from past projects with similar materials and operations.

Contractor _____

Signed By:

Signature _____

Date _____

Print Name _____

Title _____

END OF SECTION

SECTION A01563 - DECONTAMINATION UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Refer to Section A01503 Temporary Facilities - Asbestos Abatement for electrical requirements and requirements relative to connection of decontamination facilities to building systems such as water, sewer, and electrical.

1.2 DESCRIPTION OF WORK

A. Provide separate personnel and equipment decontamination facilities. Require that the Personnel Decontamination Unit be the only means of ingress and egress for the work area. Require that all materials exit the work area through the Equipment Decontamination Unit.

PART 2 - PRODUCTS

2.1 POLYETHYLENE SHEET

A. Provide flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.2 REINFORCED POLYETHYLENE SHEET:

A. Where plastic sheet is the only separation between the work are and building exterior, provide translucent, nylon reinforced, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.3 DUCT TAPE

A. Provide duct tape in 2 or 3 inch widths as indicated with an adhesive which is formulated to aggressively stick to sheet polyethylene.

2.4 SPRAY CEMENT

A. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

2.5 SHOWER PAN

A. Provide one piece waterproof shower pan 4 by 8 feet by 6 inches deep. Fabricate from seamless fiberglass minimum 1/16 inch thick reinforced with wood, 18 ga. stainless steel with welded seams, or a seamless liner or minimum 60 mil thick rubber roofing.

2.6 SHOWER WALLS

A. Provide 8 feet long by approximately 7 feet high walls fabricated from rigid, impervious, waterproof material, either corrugated fiberglass roofing or equivalent. Structurally support as necessary for stability.

2.7 SHOWER HEAD AND CONTROLS

A. Provide a factory made shower head producing a spray of water which can be adjusted for spray size and intensity. Feed shower with water mixed from hot and cold supply lines. Arrange so that control of water temperatures, flow rate, and shut off is from inside shower without outside air.

2.8 FILTERS

A. Provide cascaded filter units on drain lines from showers or any other water source carrying asbestos contaminated water from the work area. Provide units with disposable filter elements as indicated below. Connect so that discharged water passes primary filter and output of primary filter passes through secondary filter.

1. Primary Filter - Pass particles 20 microns and smaller.
2. Secondary Filter - Pass particles 5 microns and smaller.

2.9 HOSE BIBB

A. Provide heavy bronze angle type with wheel handle, vacuum breaker, and 3/4 inch National Standard male hose outlet.

2.10 SHOWER STALL

A. For Wash Down Station provide leak tight shower enclosure with integrated drain pan fabricated from fiberglass or other durable waterproof material, approximately 3 by 3 feet square with minimum 6 feet high sides and back. Structurally support as necessary for stability. Equip with hose bib, as specified in this section, mounted at approximately 4'-0" above drain pan. Connect drain to reservoir, pump water from reservoir through filters to a drain or store and use for amended water. Mount filters inside shower stall on back wall beneath hose bib.

2.11 RUBBER ROOFING

A. Provide uniform flat sheets of flexible sheet roofing material fabricated from EPDM (ethylene propylene diene monomers) or Neoprene (polychloroprene), in a nominal thickness of 45 mils.

2.12 LUMBER

A. Provide kiln dried lumber of any grade or species.

2.13 SUMP PUMP

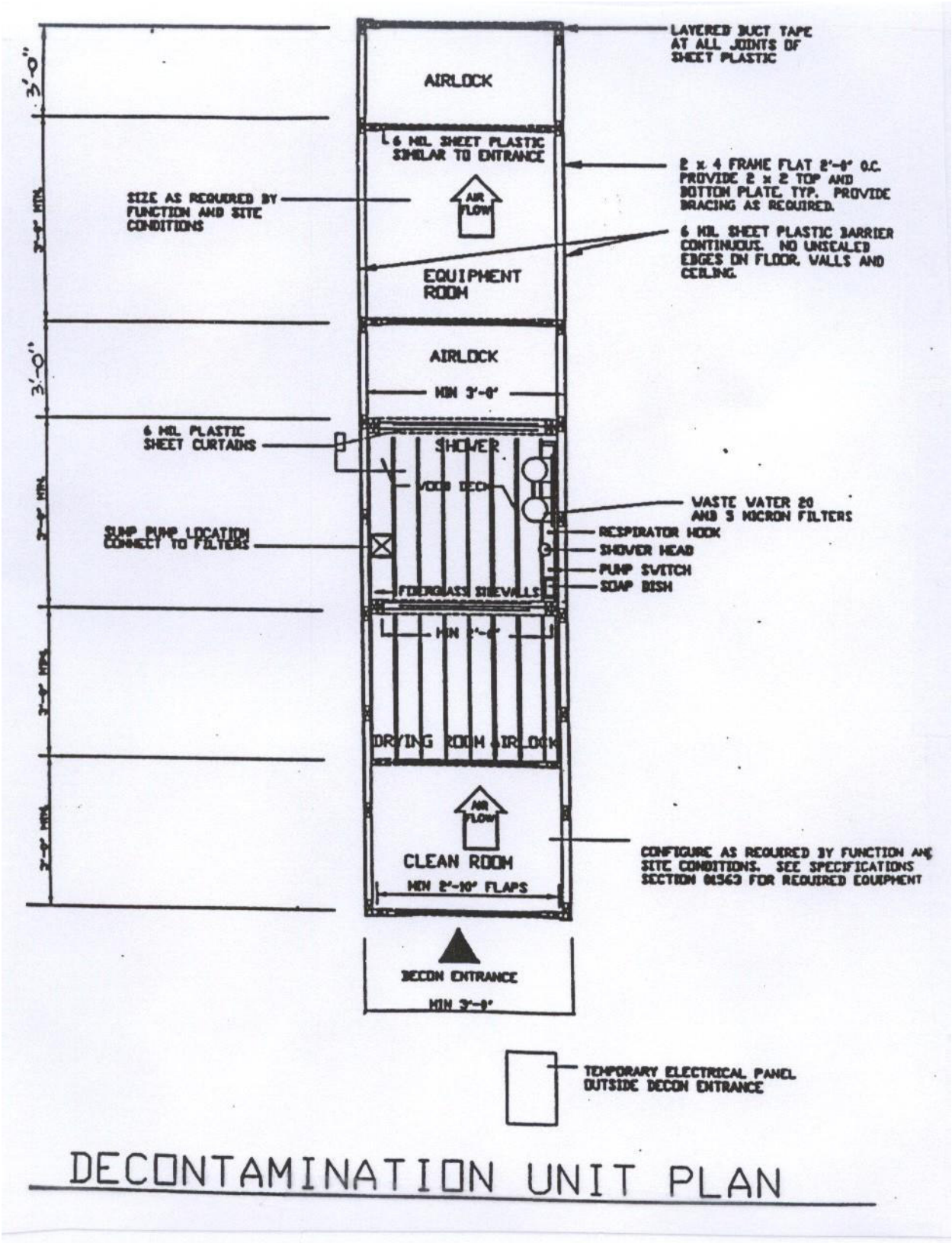
A. Provide totally submersible waterproof sump pump with integral float switch. Provide unit sided to pump 2 times the flow capacity of all showers or hoses supplying water to the sump, through the filters specified herein when they are loaded to the extent that replacement is required. Provide unit capable of pumping debris, sand, plaster or other

materials washed off during decontamination procedures without damage to mechanism of pump. Adjust float switch so that a minimum of 3 inches remains between top of liquid and top of sump pump.

PART 3 - EXECUTION

3.1 PERSONNEL DECONTAMINATION UNIT

A. Provide a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces, including Changing Room, Shower Room, and Equipment Room. Each room in the personnel and waste decontamination unit must be separated by an airlock. (See Drawing 01563-4.) Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not allow parallel routes for entry or exit. Do not remove equipment or materials through Personnel Decontamination Unit. Provide temporary lighting without decontamination units as necessary to reach a lighting level of 100 foot candles.



DECONTAMINATION UNIT PLAN

B. Changing Room (Clean Room): Provide a room that is physically and visually separated from the result of the building for the purpose of changing into protective clothing. Construct using polyethylene sheeting, at least 6 mil in thickness, to provide an airtight seal between the Changing Room and the rest of the building. Locate so that access to Work Area from Changing Room is through Shower Room. Separate Changing Room from the building by a sheet polyethylene flapped doorway.

1. Require workers to remove all street clothes in this room, dress in clean disposable coveralls, and don respiratory protection equipment. Do not allow asbestos contaminated items to enter this room. Require workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.
2. An existing room may be utilized as the Changing Room if it is suitably located and of a configuration whereby workmen may enter the Changing Room directly from the Shower Room. Protect all surfaces of room with sheet plastic as set forth in Section A01526 Temporary Enclosures. Authorization for this must be obtained from the Owner's Representative in writing prior to start of construction. Submit written request in accordance with Section A01632 Products and Substitutions detailing layout and protective measures proposed.
3. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in changing room.
4. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
5. Provide a continuously adequate supply of disposable bath towels.
6. Provide posted information for all emergency phone numbers and procedures.
7. Provide 1 storage locker per employee.
8. Provide all other components indicated on the contract drawings.

C. Shower Room: Provide a completely watertight operational shower to be used for transit by cleaning dressed workers heading for the Work Area from the Changing Room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.

1. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.
2. Separate this room from the rest of the building with air tight walls fabricated of 6 mil polyethylene.
3. Separate this room from the Changing and Equipment Rooms with air tight walls fabricated of 6 mil polyethylene.
4. Provide splashproof entrances to Changing and Equipment Rooms with 2 doors arranged in the following configuration:

    a. At each entrance to the Shower Room construct a door frame out of 2 x 4 lumber with 1-1/2 inch jambs (sides) and 1-1/2 inch head (top) and sill (bottom). Attach to this door frame two overlapping flaps of rubber roofing material, fastened at the head (top) and jambs (sides) (by clamping between a 1-1/2 by 3/4 inch batten and frame). Overlap the flaps a minimum of 6 inches in a direction that presents a shingle-like configuration to the water stream from the shower. Overlap sill (bottom) by 1-1/2 inches minimum. Arrange so that any air movement out of the Work Area will cause the flaps to seal against the door frame.
    b. At 12 inches toward shower from each entrance to the Shower Room construct a second 2 x 4 door head (top). Attach to this door head a one piece flap of rubber roofing material, fastened at the top (by clamping between a 1-1/2 by 3/4 inch batten and head), overlapping onto each side of shower unit by 1-1/2 inches and stopping 1 inch clear of shower floor.

5. Provide shower head and controls.
6. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.
7. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition.
8. Arrange so that water from showering does not splash into the Changing or Equipment Room.
9. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area.
10. Provide flexible hose shower head.
11. Pump waste water to drain or to storage for use in amended water. If pumped to drain, provide 20 micron and 5 micron waste water filters in line to drain or waste water storage. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan.
12. Provide Hose Bibb.
13. Provide all other items indicated on contract drawings.

D. Equipment Room (Contaminated Area): Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6 mil polyethylene flap doorway.

1. Separate this room from the rest of the building with air tight walls fabricated of 6 mil polyethylene.
2. Separate this room from the Shower Room and Work Area with air tight walls fabricated of 6 mil polyethylene.

E. Work Area: Separate work area from the Equipment Room by polyethylene barriers. If the airborne asbestos level in the work area is expected to be high, as in dry removal, add an intermediate cleaning space between the Equipment Room and the Work Area. Damp wipe clean all surfaces after each shift change. Provide one additional floor layer of 6 mil polyethylene per shift change and remove contaminated layer after each shift.

F. Construction:

1. Walls and Ceilings: Construct air tight walls and ceiling using polyethylene sheeting, at least 6 mil in thickness. Attach to existing building components or a temporary framework.
2. Floors: Use 2 layers (minimum) of 6 mil polyethylene sheeting to cover floors in the Equipment, Shower (underneath shower pan), and Changing Rooms. Provide an additional layer in the Equipment Room for every shift change expected. Roll one layer of plastic from Equipment Room into Work Area after each shift change. Provide a minimum of two (2) layers of plastic at all times. Use only clear plastic to cover floors.
3. Doors: Fabricated from overlapping sheets with openings a minimum of 3 feet wide. Configure so that sheeting overlaps adjacent surfaces. Weight sheets at bottoms as required so that they quickly close after being released. Put arrows on sheets to indicate direction of overlap and/or travel. Provide a minimum of 6 feet between entrance and exit of any room.
4. If the decontamination area is located within an area containing friable asbestos on overhead ceilings, ducts, piping, etc., provide the area with a minimum 1/4 inch hardboard or 1/2 inch plywood "ceiling" with polyethylene sheeting, at least 4 mil in thickness covering the top of the "ceiling".

G. Visual Barrier: Where the decontamination area is immediately adjacent to and within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least

4 mil in thickness so that worker privacy is maintained and work procedures are not visible to building occupants. Where the area adjacent to the decontamination area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with wood or metal studs covered with minimum 1/4 inch thick hardboard or 1/2 inch plywood. Where the solid barrier is provided, sheeting need not be opaque.

1. Alternate methods or providing decontamination facilities may be submitted to the Owner's Representative for approval. Do not proceed with any such method(s) without written authorization of the Owner's Representative.

H. Electrical: Provide subpanel at Changing Room to accommodate all removal equipment. Power subpanel directly from a building electrical panel. Connect all electrical branch circuits in decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.

3.2 DECONTAMINATION SEQUENCE

A. Entering Work Area:

1. Worker enters Changing Room and removes street clothing, puts on clean disposable overalls and respirator, and passes through the Shower Room into the Equipment Room.
2. Any additional clothing and equipment left in Equipment Room needed by the worker area put on in the Equipment Room.
3. Worker proceeds to Work Area.

B. Exiting Work Area:

1. Before leaving the work area, require the worker to remove all gross contamination and debris from overalls and feet. The worker then proceeds to the Equipment Room and removes all clothing except respirator protection equipment. Extra work clothing may be stored in contaminated end of the Equipment Room. Disposable coveralls are placed in a bag for disposal with other material. Decontamination procedures found in Section A01560 shall be followed by all individuals leaving the work area.
2. After showering, the worker moves to the Changing Room and dresses in either new coveralls for another entry or street clothes if leaving.

3.3 EQUIPMENT DECONTAMINATION UNITS

A. Provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms, Clean Room, Holding Room, Wash Room for removal of equipment and material from work area. Do not allow personnel to enter or exit work area through Equipment Decontamination Unit.

B. Wash Down Station: Provide an enclosed shower unit located in work area just outside Wash Room as an equipment, bag and container cleaning station.

C. Wash Room: Provide wash room for cleaning of bagged or containered asbestos-containing waste materials passed from the work area. Construct wash room of 2x wood framing and polyethylene sheeting, at least 6 mil in thickness and located so that packaged materials, after being wiped clean can be passed to the Holding Room. Separate this room from the work area by a single flap of 6 mil polyethylene sheeting.

D. Holding Room: Provide Holding Room as a drop location for bagged asbestos-containing materials passed from the Wash Room. Construct Holding Room of 2x wood framing and polyethylene sheeting, at least 6 mil in thickness and located so that bagged materials cannot be passed from the Wash Room through the Holding Room to the Clean Room. Separate this room from the adjacent rooms by double flaps fabricated from ±1/16 inch thick single ply rubber roofing material either EPDM or Neoprene.

E. Clean Room: Provide Clean Room to isolate the Holding Room from the building exterior. Construct Clean Room of 2x wood framing and polyethylene sheeting, at least 6 mil in thickness and locate to provide access to the Holding Room from the building exterior by a single flap of 6 mil polyethylene sheeting.

F. Equipment or Material: Take all equipment or material from the work area through the Equipment Decontamination Unit according to the following procedures:

1. At washdown station, thoroughly wet-clean contaminated equipment or sealed polyethylene bags and pass into Wash Room.
2. When passing equipment or containers into the Wash Room, close all doorways of the Equipment Decontamination Unit, other than the doorway between the Washdown Station and the Wash Room. Keep all outside personnel clear of the Equipment Decontamination Unit.
3. Once inside the washroom, wet-clean the bags and/or equipment.
4. When cleaning is complete pass items into Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room.
5. Workers from the building exterior enter Holding Area and remove decontaminated equipment and/or containers for disposal.
6. Require these workers to wear full protective clothing and wearing appropriate respiratory protection.
7. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.
8. All bags of ACM waste material must be double bagged when brought out through the waste decon.

3.4 CLEANING OF DECONTAMINATION UNITS

A. Clean debris and residue from inside of Decontamination Units on a daily basis or as otherwise indicated on contract drawings. Damp wipe or hose down all surfaces after each shift change. Clean debris from shower pans on a daily basis.

B. If the Changing Room of the Personnel Decontamination Unit becomes contaminated with asbestos-containing debris, abandon the entire decontamination unit and erect a new decontamination unit. Use the former Changing Room as an inner section of the new Equipment Room.

3.5 SIGNS

A. Post an approximately 20 by 14 inch manufactured warning sign at each entrance to the work area displaying the following text with letter sizes and styles of a visibility required by 29 CFR 1926:

Warning signs shall bear the following information:

DANGER
ASBESTOS

MAY CAUSE CANCER
CAUSES DAMAGES TO LUNGS
AUTHORIZED PERSONNEL ONLY

B. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each work area displaying the following text with letter sizes and styles of a visibility at least equal to the following:

Sign Text	Notation
No Food, Beverages or Tobacco Permitted	3/4" Block
All Persons Shall Don Protective Clothing (Coverings) Before Entering the Work Area	3/4" Block
All Persons Shall Shower Immediately After Leaving Work Area and Before Entering the Changing Area	3/4" Block

END OF SECTION

SECTION A01632 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF REQUIREMENTS

A. Definitions: Definitions used in this article are not intended to negate the meaning of other terms used in the contract documents, including such terms as "special construction", and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

B. "Products" are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term "product" as used herein includes the terms "material", "equipment", "system" and other terms of similar intent.

C. "Named Products" are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in manufacturer's published product literature, of the latest issue as of the date of the contract documents.

D. "Materials" are products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form units of work.

E. "Equipment" is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.3 PROCEDURES

A. Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the contract documents are considered requests for "substitutions", and are subject to the requirements specified herein.

B. Standards: Refer to Section A01091 "Definitions and Standards" for the applicability of industry standards to the products specified for the project, and for the acronyms used in the text of the specification sections.

1.4 QUALITY ASSURANCE

A. To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. When it is discovered that specified products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Owner's Representative for a determination of what product qualities are most important before proceeding. The Owner's Representative will designate those qualities, such as visual, structural durability, or compatibility, that are most important. When the Owner's Representative's determination has been made, select products from those sources that produce products that possess the most important qualities, to the fullest extent possible.

1.5 SUBMITTALS

A. Substitution Request Submittal:

1. Request for Substitutions: Submit 3 copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; inside related specification section and drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include the following information, as appropriate, with each request:

a. Provide a detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities include elements such as size, weight, durability, performance and visual effect where applicable.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control to prevent overcrowding of construction spaces. In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

PART 2 - PRODUCTS

2.1 WORK RELATED SUBMITTALS

A. The Contractor's submittal of, and the Owner's Representative's acceptance of, shop drawings, product data or samples which relate to work not complying with requirements of the contract documents, does not constitute an acceptable or valid request for a substitution nor approval thereof.

2.2 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the contract documents that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated.

B. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION

SECTION A01701 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF REQUIREMENTS

A. Definitions: Project closeout is the term used to describe certain collective project requirements, indicating completion of the Work, that are to be fulfilled near the end of the Contract time in preparation for final acceptance and occupancy of the Work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

B. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single time period for the entire Work or a series of time periods for individual elements of the Work that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this section.

1.3 PREREQUISITES TO SUBSTANTIAL COMPLETION

A. General: Complete the following before requesting the Owner's Representative to inspect the certification of substantial completion, either for the entire Work or for portions of the Work. Include list of known exceptions.

1. Include supporting documentation for completion as indicated in these contract documents.
2. Submit a statement showing an accounting of changes to the Contract Sum.
3. Advise Owner of pending insurance change-over requirements.
4. Submit specified warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
5. Obtain and submit releases enabling Owner's fully, unrestricted use of the Work and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.

B. Inspection Procedures: Upon receipt of Contractor's request for inspection, the Owner's Representative will either proceed with inspection or advise Contractor of unfulfilled prerequisites.

1. Following initial inspection, Owner's Representative will either prepare the Certificate of Substantial Completion, or will advise Contractor of work which must be performed before the Certificate will be issued. The Owner's Representative will repeat the inspection when requested and when assured that the Work has been substantially completed.
2. Results of the completed inspection will form the initial "Punch-List" for final acceptance.

1.4 PREREQUISITES TO FINAL ACCEPTANCE

A. General: Complete the following before requesting the Owner's Representative's final inspection for certification of final acceptance, and final payment as required by the General Conditions. List known exceptions, if any, in request.

1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit a certified copy of the Owner's Representative's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the owner's Representative and Owner.
3. Submit Consent of Surety.
4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Owner's Representative will reinspect the Work upon receipt of the Contractor's notice that the work, including punch-list items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Owner's Representative.

C. Upon completion of reinspection, the Owner's Representative will either prepare a certificate of final acceptance, or will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.

D. If necessary, the reinspection procedure will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in "submittal" sections.

B. Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with the actual performance of the Work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Owner's Representative for the Owner's records.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Special cleaning requirements for specific units of Work are included in the appropriate sections of Divisions 2 through 33. General Cleaning during the regular progress of the Work is required by the General Conditions and is included under section "Temporary Facilities and Controls".

B. Cleaning: Provide final cleaning of the Work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal commercial building cleaning and maintenance program. Comply with the manufacturer's instructions for operations.

1. Clean exposed hard-surfaced finishes affected by the work to a dirt-free condition, free of dust, stains, films and similar distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.

C. Vacuum clean with HEPA vacuum carpeted surfaces and similar soft surfaces and/or professional clean to remove staining caused by work of this contract.

D. Clean plumbing fixtures affected by the work to a sanitary condition, free of stains including those resulting from water exposure.

E. Replace all HVAC filters using materials supplied by Owner or clean non-replaceable filters after minimum of two days of operation of HVAC equipment.

F. Clean light fixtures and lamps which have been affected by the work so as to function with fully efficiency. Replace lamps where inoperable.

G. Clean project site (yard and grounds), including landscaped areas, of litter and foreign substances left during the course of the work. Sweep paved areas which have been effected by the work to a broom-clean condition; remove stains, petrochemical spills and other foreign deposits left by the work. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface where they have been disturbed by the Work.

H. Removal of Protection: Except as otherwise indicated or requested by the Owner's Representatives, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

I. Compliances: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these to the Owner's best advantage as directed.

J. Damages: Contractor to repair or replace finishes, building systems damaged by the abatement procedures. This includes but is not limited to ceilings, wall finishes, flooring materials, etc. At the conclusion of the project all finishes are to be returned to original or better condition.

END OF SECTION

SECTION A01711 - PROJECT DECONTAMINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Removal of Gross Debris: Is integral with the performance of abatement work and as such is specified in the appropriate work section(s) of these specifications:

a. Section A02081 Removal of Asbestos Containing Materials.

2. Work Area Clearance: Air testing and other requirements which must be met before release of Contractor and reoccupancy of the work area are specified in Section A01714.
3. Encapsulation: Specified in Section A02081 for removal of asbestos-containing materials.

1.2 DESCRIPTION OF REQUIREMENTS

A. General: Decontamination of the Work Area following asbestos abatement.

B. If the asbestos abatement work is on damaged or friable materials, then the building space is deemed contaminated before start of the work and in need of decontamination. In this case the work is a four step procedure to its removal and two cleanings of the room surfaces to remove any new or existing contamination.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Work of This Section: Includes the decontamination of air in the Work Area which has been, or may have been contaminated by the elevated airborne asbestos fiber levels generated during abatement activities, or which may previously have had elevated fiber levels due to friable asbestos containing materials in the space.

B. Work of This Section: Includes the cleaning, decontamination, and removal of temporary facilities installed prior to abatement work, including:

1. Primary and Critical barriers erected by work of Section A01526.
2. Decontamination Units erected by work of Section A01563.
3. Negative Pressure System installed by work of Section A01513.

3.2 START OF WORK

A. Previous Work: During completion of the asbestos abatement work specified in other Sections, the Secondary Barrier of polyethylene sheeting will have been removed and disposed of along with any gross debris generated by the asbestos abatement work.

B. Start of Work: Work of this section begins with the cleaning of the Primary Barrier. At the start of work the following will be in place:

1. Primary Barrier: One layer of reinforced polyethylene plus two layers of polyethylene sheeting on floor and one layer on walls.
2. Critical Barrier which forms the sole barrier between the work area and other portions of the building or the outside.
3. Critical Barrier Sheeting over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.

C. Decontamination Units: For personnel and equipment in operating condition.

D. Negative Pressure System: In operation.

3.3 FIRST CLEANING

A. First Cleaning: Carry out a first cleaning of all surfaces of the work area including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and/or a High Efficiency Particulate Absolute (HEPA) filtered vacuum. (NOTE: A HEPA vacuum will fail if used with wet material.) Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces.

1. Remove all Filters in Air-handling System(s) and dispose of as asbestos containing waste in accordance with requirements of Section A02084.
2. Visual inspection.

B. Wait 12 hours to allow negative air machines to clean air of airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work areas during this period. Maintain negative pressure system in operation for the entire 12 hour period.

3.4 SECOND CLEANING

A. Second Cleaning: Carry out a second cleaning of all surfaces in the work area in the same manner as the first cleaning.

B. Immediately following the second cleaning of the primary plastic, remove all Primary Barrier sheeting and Material Decontamination Unit, if there is one, leaving only:

1. Critical Barrier: Which forms the sole barrier between the work area and other portions of the building or the outside.
2. Critical Barrier Sheeting: Over lighting fixtures and clocks ventilation openings, doorways, convectors, speakers and other openings.

    a. Decontamination Unit: For personal in operating condition.

3. Negative Pressure System: Maintain in continuous operation.

3.5 THIRD CLEANING

A. Third Cleaning: Carry out a third cleaning of all surfaces in the work area in the same manner as the first cleaning immediately after removal of primary plastic. This cleaning is

now being applied to existing room surfaces. Take care to avoid water marks or other damage to surfaces.

B. Wait to 24 hours to allow negative air machines to clean air of airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work area during this period. Maintain negative pressure system in operation for the entire 24 hour period.

3.6 FINAL CLEANING

A. Final Cleaning: Carry out a final cleaning of all surfaces in the work area in the same manner as the previous cleaning.

B. Wait 24 hours to allow negative air machines to clean air of airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work areas during this period. Maintain negative pressure system in operation for the entire 24 hour period.

3.7 VISUAL INSPECTION:

A. After 24 hours Perform a Complete Visual Inspection of the entire area including: decontamination unit, all plastic sheeting, seals over ventilation opening, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter. If any such debris, residue, dust or other matter is found repeat final cleaning and continue decontamination procedure from that point. When the area is visually clean, complete the certification at the end of this section. Visual inspection is not complete until confirmed in writing, on the certification, by Project Administrator.

3.8 FINAL AIR SAMPLING

A. Transmission Electron Microscopy (TEM): After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedure for transmission electron microscopy set forth in Section A01714:

1. If release Criteria is not met, repeat Final Cleaning and continue decontamination procedure from that point.
2. If Release Criteria is met, remove the Critical Barriers separating the work area from the rest of the building and shut down and remove the negative pressure system.

3.9 COMPLETION OF ABATEMENT WORK

A. Seal negative air machines with 6 mil polyethylene sheet and duct tape to form a tight seal at intake end before being moved from work area.

B. Asbestos Abatement Work is Complete upon meeting the work area clearance criteria and fulfilling the following:

1. Remove all equipment, materials, debris from the worksite.
2. Dispose of all asbestos containing waste material as specified in Section A02084.
3. Repair or replace all interior finishes damaged during the course of asbestos abatement work.
4. Fulfill Project Closeout Requirements of Section A01701.

3.10 CERTIFICATE OF VISUAL INSPECTION

A. Following this section is a "Certificate of Visual Inspection". This certification is to be completed by the Contractor and certified by the Project Administrator. Submit completed certificate with application for final payment. Final payment will not be made until this certification is executed.

CERTIFICATION OF VISUAL INSPECTION:

In accordance with Section A01711 "Project Decontamination" the Contractor hereby certifies that he has visually inspected the work area (all surfaces including pipes, beams, ledges, walls, ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris or residue.

BY: (Signature) Date

(Print Name)

(Print Title)

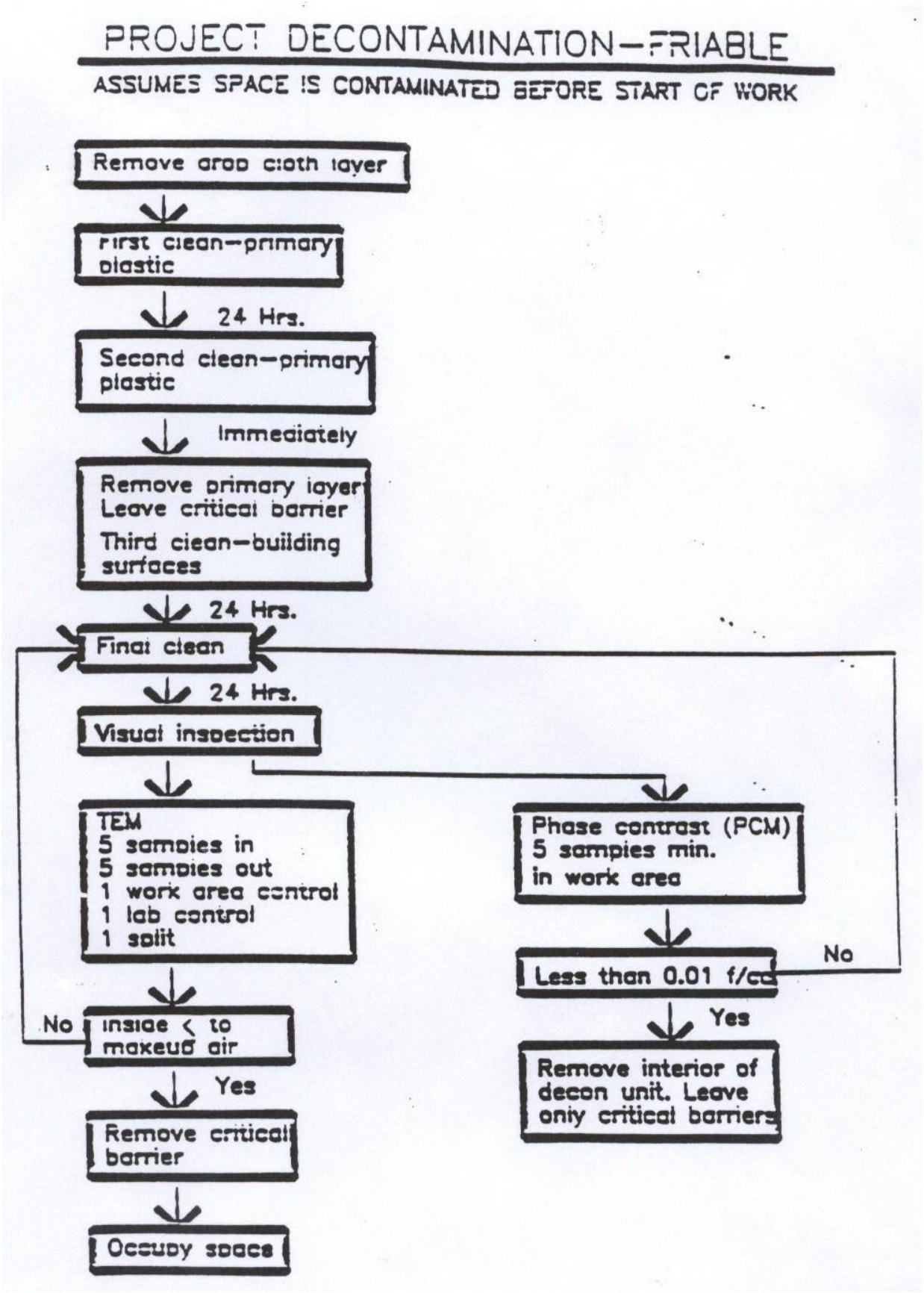
PROJECT ADMINISTRATOR CERTIFICATION:

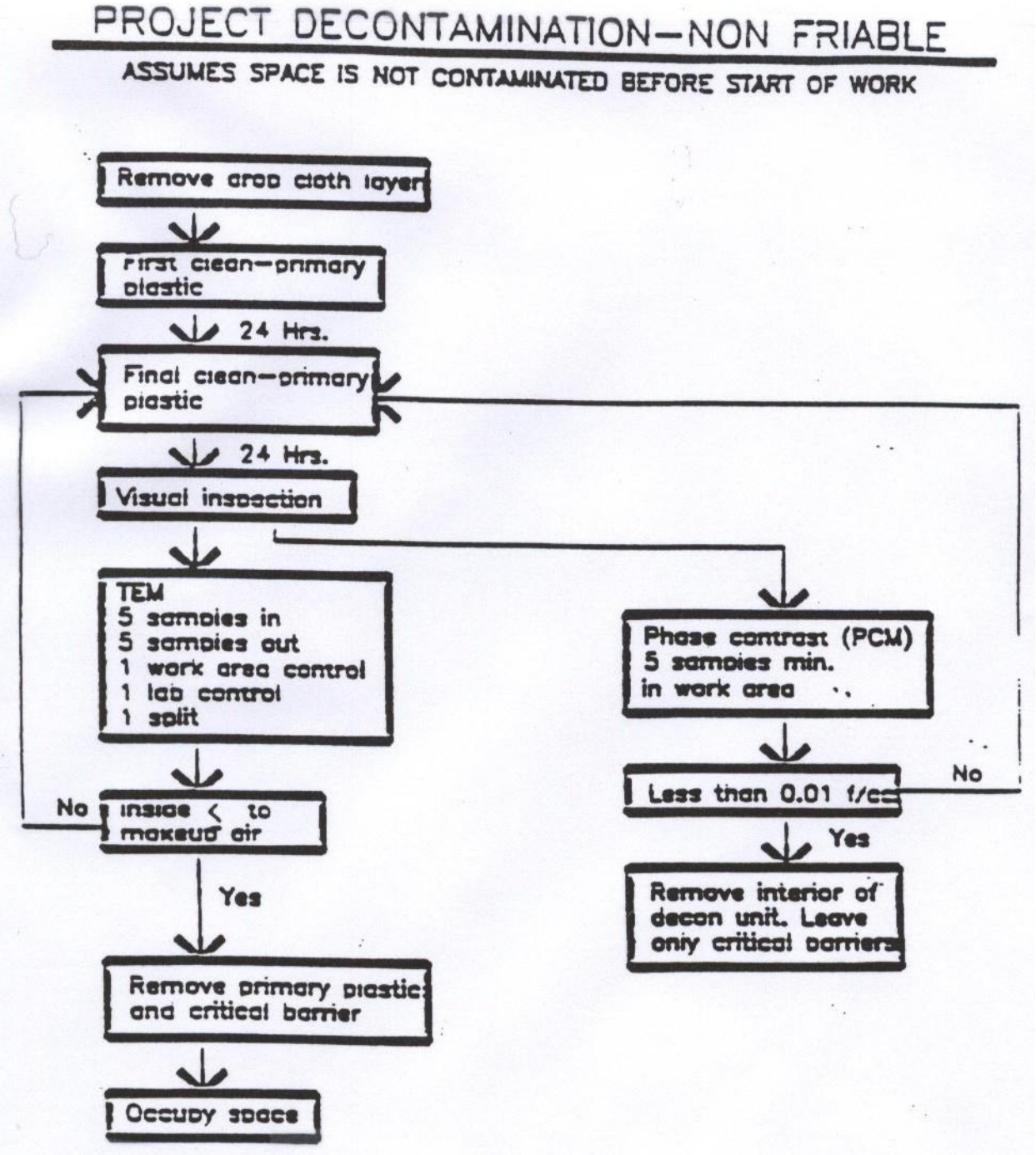
The Project Administrator hereby certifies that he has accompanied the Contractor on his visual inspection and verified that this inspection has been thorough and to the best of his knowledge and belief, the Contractor's certification above is a true and honest one.

BY: (Signature) Date

(Print Name)

(Print Title)


PROJECT DECONTAMINATION—FRIABLE
ASSUMES SPACE IS CONTAMINATED BEFORE START OF WORK
Remove drop cloth layer
First clean—primary plastic
24 Hrs.
Second clean—primary plastic
Immediately
Remove primary layer
Leave critical barrier
Third clean—building surfaces
24 Hrs.
Final clean
24 Hrs.
Visual inspection
TEM
5 samples in
5 samples out
1 work area control
1 lab control
1 split
Phase contrast (PCM)
5 samples min.
in work area
Less than 0.01 f/cc
No
Yes
Remove interior of decon unit. Leave only critical barriers
No
Inside < to makeup air
Yes
Remove critical barrier
Occupy space



END OF SECTION

SECTION A01714 - WORK AREA CLEARANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The cost of final "TEM" air clearance testing is the responsibility of the Owner and will be done by an independent air monitoring firm. PCM by Contractor.

B. Should clearance levels not be attained, the sampling and analysis cost will be backcharged to the Contractor.

1.3 CONTRACTOR RELEASE CRITERIA

A. The Work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below.

1.4 AIR MONITORING

A. To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the Contractor-Owner will secure samples and analyze them according to the following procedures:

1. Fiber Count: "Fibers" referred to in this section shall be either all fibers regardless of composition, as counted in the P&CAM 239, NIOSH 7400, or OSHA Reference Method Procedures, or asbestos fibers of any size as counted using either a Scanning or Transmission Electron Microscope.

1.5 AGGRESSIVE SAMPLING

A. All air samples will be taken using aggressive sampling techniques as follows:

1. There are no standards available for flow rate of leaf blowers or large fans. However, this information is not critical to the success of the procedure.
2. Before sampling pumps are started the exhaust from forced air equipment (leaf blower with at least 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for 5 minutes per 10,000 cubic feet of room volume.
3. One 20 inch diameter fan per 10,000 cubic feet of room volume will be mounted in a central location at approximately 2 meters above floor, directed toward ceiling and operated at low speed for the entire period of sample collection.
4. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors of vents.
5. After air sampling pumps have been shut off, fans will be shut off.

1.6 SCHEDULE OF AIR SAMPLES

A. General: The number and volume of air samples taken and analytical methods used by the Contractor will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used.

1.7 TRANSMISSION ELECTRON MICROSCOPE

A. In each homogeneous work area after completion of all cleaning work, a minimum of 12 samples will be taken and analyzed as follows:

Location Sampled	Number of Samples	Detection Filter Media	Min Limit Fibers/cc.	Volume (Liters)	Rate LPM
Each Work Area	5	Polycarbonate	0.005	3000	2-12
Outside Work Area	5	Polycarbonate	0.005	3000	2-12
At Job Site	1	Polycarbonate	0.005	0	0
At Laboratory	1	Polycarbonate	0.005	0	0

B. Analysis: Asbestos fibers on each filter will be measured using the Level 1 analysis per EPA Provisional Method and Update (USEPA 1977, Yamate 1984).

C. Direct Transfer Method of sample preparation will be used if possible.

D. Split Sample: One work area sample will be split and both halves analyzed separately for duplicate analysis.

E. Release Criteria: Decontamination of the work site is complete if the average fiber concentration of the work area is not statistically larger than the average of outside samples for each homogeneous work area. If the average of the work area samples is statistically larger than the average of the outside samples then the decontamination is incomplete and the cleaning procedures of Section A01711 shall be repeated.

1.8 LABORATORY TESTING

A. Transmission Electron Microscopy: Samples will be sent by overnight courier for analysis by Transmission Electron Microscopy. Verbal results will be available during the 24 hours after samples are taken. The laboratory is capable of analyzing a maximum of 10 such samples from this project at any one time. A complete record, certified by the testing laboratory, of all Transmission Electron Microscopy results will be furnished to the Owner's Representative, the Owner and the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION A02081 - REMOVAL OF ASBESTOS-CONTAINING MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section A01526 "Temporary Enclosures" for installation of critical and primary barriers, and work area isolation procedures.
2. Section A01711 "Project Decontamination" for decontamination procedures after removal of the secondary barrier.
3. Section A02084 "Disposal of Asbestos-Containing Waste Material" for disposal of asbestos-containing waste.

1.2 SUMMARY

A. Section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.

1.3 SUBMITTALS

A. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use.

1. Surfactant: Submit product data, use instructions and recommendations from manufacturer of surfactant intended for use. Include data substantiating that material complies with requirements.
2. Removal Encapsulant: Submit product data, use instructions and recommendations from manufacturer of removal encapsulant intended for use. Include data substantiating that material complies with requirements.
3. NESHAPS Certification: Submit certification from manufacturer of surfactant or removal encapsulant that, to the extent required by this specification, the material, if used in accordance with manufacturer's instructions, will wet asbestos containing materials to which it is applied as required by the National Emission Standard of Hazardous Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M).
4. Safety Data Sheet: Submit the Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the Work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

PART 2 - PRODUCTS

2.1 WETTING MATERIALS

A. For wetting prior to disturbance of asbestos-containing materials use either amended water or a removal encapsulant:

1. Amended Water: Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by the use of one ounce of a surfactant consisting of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with five gallons of water.
2. Removal Encapsulant: Provide a penetrating type encapsulant designed specifically for removal of asbestos-containing material. Use a material which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with five gallons of water.

2.2 POLYETHYLENE SHEET

A. Provide flame resistant polyethylene film that conforms to requirements set forth by NFPA 701 "Fire Tests for Flame Propagation of Textiles and Films." Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.3 DUCT TAPE

A. Provide duct tape in 2 or 3 inch widths as indicated with an adhesive which is formulated to aggressively stick to sheet polyethylene.

2.4 SPRAY CEMENT

A. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

2.5 DISPOSAL BAGS

A. Provide 6 mil thick leak-tight polyethylene bags labeled with two labels with text as follows:

1. First Label:

CAUTION
Contains Asbestos Fibers
Avoid Opening or Breaking Container
Breathing Asbestos is Hazardous to Your Health

2. Second Label (provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard):

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

PART 3 - EXECUTION

3.1 SECONDARY BARRIER

A. Secondary Barrier: Over the Primary Barrier, install as a drop a clear 6 mil sheet plastic in all areas where asbestos removal work is to be carried out. Completely cover floor with sheet plastic. Where the work is within 10 feet of a wall, extend the Secondary Barrier up wall to ceiling. Support sheet plastic on wall with duct tape, seal top of Secondary plastic to Primary Barrier with duct tape so that debris is unable to get behind it. Provide cross strips of duct tape at wall support as necessary to support sheet plastic and prevent its falling during removal operations.

B. Install: Secondary Barrier at the beginning of each work shift. Install only sufficient plastic for work of that shift.

C. Remove Secondary Barrier at end of each work shift or as work in an area is completed. Fold plastic toward center of sheet and pack in disposal bags. Keep material on sheet continuously wet until bagged.

D. Install Walkways of black 6 mil plastic between active removal areas and decontamination units to protect Primary Layer from tracked material. Install walkways at beginning of, and remove at end of, each work shift.

3.2 WORKER PROTECTION

A. Before beginning work with any material for which a Safety Data Sheet has been submitted provide workers with the required protective equipment. Require that appropriate protective equipment is used at all times.

3.3 WET REMOVAL

A. Thoroughly wet to satisfaction of Owner's Representative asbestos-containing materials to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water or removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. Perforate outer covering of any insulation which has been painted and/or jacketed in order to allow penetration of amended water or removal encapsulant or where necessary, carefully strip away while simultaneously spraying amended water or removal encapsulant on the insulation to minimize dispersal of asbestos fibers into the air.

B. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.

C. Remove saturated asbestos-containing material in small section from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to washdown station adjacent to material decontamination unit.

1. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.

D. Pipe Insulation: Spray with a mist of amended water or removal encapsulant. Allow amended water or removal encapsulant to saturate material to substrate. If a removal encapsulant is used, use in strict accordance with manufacturer's instructions. Cut bands holding preformed pipe insulation, slit jackets at seams, remove and hand-place in a disposal bag. Remove job molded fitting insulation in chunks and hand place in a disposal bag. Do not drop to floor. Remove any residue on pipe or fitting with stiff bristle nylon hand brush. In locations where pipe filter insulation is removed from pipe with straight runs insulated with fibrous glass or other non-asbestos containing fibrous material, remove fibrous material 6 inches from the point where it contacts the asbestos-containing insulation.

E. Pipe Tunnel Floor (Friable Asbestos Contaminated Material): Remove 3 inch minimum layer of dirt (sand and gravel) from the tunnel floors. Material shall be removed either by HEPA vacuum or by hand and placed in disposal bags. Due to the weight of the material additional bags shall be used for disposal. Mist areas being removed with amended water and penetrating encapsulant.

F. Floor Tile (Non-friable Asbestos Contaminated Material): Remove floor tile and adhesive from concrete floor. Mist area with amended water during gross removal process to keep fiber count down. Double bag all material being removed from the work area. Remove residue with stiff brush and spray entire floor area with a penetrating encapsulant compatible with new floor tile adhesive.

G. Breeching Insulation: Spray with a mist of amended water or removal encapsulant. Allow amended water or removal encapsulant to saturate material to substrate. If a removal encapsulant is used, use in strict accordance with manufacturer's instructions. Cut bands holding preformed pipe insulation, slit jackets at seams, remove and hand-place in a disposal bag. Remove job molded fitting insulation in chunks and hand place in a disposal bag. Do not drop to floor. Remove any residue on breeching or fitting with stiff bristle nylon hand brush. In locations where insulation is removed from breeching remove material 12 inches beyond the point where metal removal is to be done. Seal ends of exposed asbestos containing materials with encapsulant and treated fabric.

H. Spray-On Architectural Finish: Spray with a mist of amended water and removal encapsulant. Existing ceiling coating contains amosite and has been previously encapsulated with a penetrating encapsulant. This material should be treated with added caution as wetting will be extremely difficult. Allow amended water and removal encapsulant to saturate material to substrate. This process may require three applications at two hour intervals. Removal encapsulant used should be in strict accordance with manufacturer's instructions. Scrape materials in small quantities from the ceiling and hand place in a disposal bag.

3.4 AIRBORNE FIBER COUNTS

A. General: Use work procedures that result in an 8 hour Time Weighted Average (TWA) airborne fiber count less than that indicated in Section A01410 "Air Monitoring - Test Laboratory Services." If airborne fiber counts exceed this level, immediately mist the area with amended water to lower fiber counts and revise work procedures to maintain airborne fiber levels within the required limit.

END OF SECTION

SECTION A02084 - DISPOSAL OF ASBESTOS - CONTAINING WASTE MATERIAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section A01092 "Codes and Regulations - Asbestos Abatement" describes applicable Federal, State, and Local Regulations.

1.2 DISPOSAL

A. Friable asbestos-containing waste material and debris, which is packaged in accordance with the provision of this Specification, may be disposed of at designated sanitary landfills when certain precautions are taken including the following:

1. Notice to Appropriate Environmental Protection Agency regional office.
2. Notice and Permit from Appropriate State and/or Local Agencies.
3. See Section A01092 for Agency Locations and Codes.

B. Dispose of non-friable asbestos containing material in accordance with applicable regulations.

1.3 SUBMITTALS

A. Submit copies of all manifests and landfill receipts to Owner's Representative on a weekly basis.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Carefully load containerized waste on sealed trucks or other appropriate vehicles for transport. Exercise care, before and during transport, to insure that no unauthorized persons have access to the material.

B. Do not store disposal bagged material outside of the work area. Take bags from the work area directly to a sealed truck or dumpster.

C. Do not transport disposal bagged materials on open trucks. Double bagged material may be transported on open trucks if they are first loaded in sealed drums. Label drums with same warning labels as bags. Uncontaminated drums may be reused. Treat drums that have been contaminated as asbestos-containing waste and dispose of in accordance with specification.

D. Advise the sanitary landfill operator, at least 24 hours in advance of transport, of the quantity of material to be delivered.

E. At the burial site, sealed plastic bags may be carefully dumped from the truck. If bags are broken or damaged, leave in the truck and clean entire truck and contents using procedures set forth in Section A01711 "Project Decontamination".

F. Retain receipts from landfill for materials disposed of.

END OF SECTION

GENERAL CONSTRUCTION INDEX

SECTION NO TITLE

DIVISION 02 – EXISTING CONDITIONS

024119 SELECTIVE DEMOLITION

DIVISION 04 – MASONRY

042000 UNIT MASONRY ASSEMBLIES

055100 METAL STAIRS

055213 PIPE AND TUBE RAILINGS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

061000 ROUGH CARPENTRY

062023 INTERIOR FINISH CARPENTRY

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

072100 BUILDING INSULATION

072419 EXTERIOR INSULATION AND FINISH SYSTEM

074213 METAL COMPOSITE MATERIAL WALL PANELS

078400 FIRESTOPPING

079200 JOINT SEALANT

DIVISION 08 – OPENINGS

081113 HOLLOW METAL DOORS AND FRAMES

081416 FLUSH WOOD DOORS

081540 FRP/ALUMINUM HYBRID ENTRANCES AND ALUMINUM FRAMES

085113 ALUMINUM WINDOWS

085850 ALUMINUM SLIDING SERVICE WINDOW

087100 FINISH HARDWARE

088000 GLASS AND GLAZING

DIVISION 09 – FINISHE

092900 GYPSUM BOARD ASSEMBLIE

093000 TILE WOR

095113 ACOUSTICAL PANEL CEILING

095423 LINEAR WOOD VENEER CEILING

096513 RESILIENT BASE AND ACCESSORIES

096519 RESILIENT TILE FLOORING

096723 RESINOUS FLOORING

099100 PAINTING

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DIVISION 10 – SPECIALTIES

101100 MARKERBOARDS

101400 INTERIOR SIGNAGE

102226 OPERABLE PARTITIONS

102800 TOILET ACCESSORIES

105113 METAL LOCKERS

107316 PRE-ENGINEERED METAL CANOPIES

DIVISION 12 – FURNISHINGS

122413 WINDOW SHADES

DIVISION 13 – SPECIAL CONSTRUCTION

133400 FABRICATED ENGINEERED STRUCTURES

DIVISION 31 – EARTHWORK

311201 SITE PREPARATION

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312501 EROSION, SEDIMENT AND POLLUTION CONTROL

DIVISION 32 – EXTERIOR IMPROVEMENTS

321201 ASPHALT PAVING

321301 SITE CONCRETE WORK

329001 PLANTING

329201 SODDED LAWNS

334001 STORM DRAINAGE

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Miscellaneous stored items throughout existing pool area and shower rooms.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.10 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video, and templates.

1. Inventory and record the condition of items to be removed and salvaged.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and after flame-cutting operations. Comply with requirements of the Fire Code Of New York State.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. 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.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement-based Self-Leveling Underlayment: 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.

1. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

a. ARDEX K 13™; Manufactured by ARDEX AMERICAS, USA, (724) 203-5000, www.ardexamericas.com

2. Performance and Physical Properties: Meet or exceed the following values for material cured at 73° F+/-3°F (23° C+/-3°C) and 50% +/-5% relative humidity:

    a. Application: Barrel Mix or Pump
    b. Compressive Strength: 5,300 psi (371 kg/cm2) at 28 days, ASTM C109M.
    c. Flexural Strength: 1,000 psi (70 kg/cm2) at 28 days, ASTM C348
    d. VOC: 0
3. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

B. Water: Potable and at a temperature of not more than 70 deg F.

C. 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 13.
3. Non-porous substrates such as burnished concrete, terrazzo, well-bonded ceramic and quarry tile, epoxy coating systems, non-water soluble adhesive residue on concrete and concrete treated with silicate compounds: ARDEX P 82™ Ultra Prime

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of **3 lb** of water/1000 sq. ft. in 24 hours.

C. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.

3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

4. Underlayment Thickness: **1/4-inch** unless otherwise indicated.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.
1. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Apply surface sealer at rate recommended by manufacturer.

G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

SECTION 042000 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 072100 "Building Insulation."
2. Section 079200 "Joint Sealants."

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Precast concrete lintels.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Cavity wall insulation.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. 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, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
4. Precast concrete components, indicating details, layout, reinforcing and surrounding construction.

C. Samples:

1. Verification sample of Precast Conrete Sill

1.6 INFORMATIONAL SUBMITTALS

A. Test Reports:

1. Concrete Masonry Units: Submit certified test reports for each size showing that units for delivery to the Project meet the requirements of these Specifications.

B. Material Certificates: For each type of the following:

1. Cementitious materials. Include name of manufacturer, brand name, and type.
2. Mortar admixtures.
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.
8. Stone Trim Units: ASTM certificate.

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

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Contractor shall employ and pay a licensed land surveyor to survey foundations for compliance with dimensional tolerances specified in referenced unit masonry standard.

B. Prism Tests: For each type of wall construction indicated, masonry prisms shall be tested in accordance with ASTM C 1314.

C. Mortar Composition and properties shall be tested in accordance with ASTM C 780, if Property Specification is used.

D. Mortar proportions shall be evaluated in accordance with ASTM C 270, if Proportion Specification is used.

E. Grout compressive strength shall be tested in accordance with ASTM 1019.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units 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 units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

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

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

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

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one 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.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and 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 from mortar splatter by spreading coverings 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.
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.

D. Cold-Weather Requirements: 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. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

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

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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, from single source from single manufacturer for each product required.

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

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 "Specification for Masonry Structures," except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.3 CONCRETE MASONRY UNITS

A. General: Provide hollow units with 2-core design complying with ASTM C 90, except as otherwise indicated or required. Provide solid units complying with ASTM C 55 where indicated or required. Provide bullnosed units at all window jambs, door jambs, column enclosures and other outside corners for all interior CMU unless noted otherwise. Provide special blocks for corners, jambs, bond beams, and special conditions. Use standard units with nominal face dimensions of 16 inch long by 8 inch high and nominal thickness as indicated.

B. Standard CMU for unexposed or painted application: ASTM C 90, Light Weight. Unit compressive strength shall be at least 2800 psi for the average net-area. Nominal 4, 6, 8, 10, or 12 inch thickness as indicated on drawings.

2.4 PRECAST CONCRETE SILLS

A. Architectural reinforced precast concrete sills in profiles and shapes indicated as manufactured by Dagostino Building Blocks or equal, complying with the following:

1. Cement: ASTM C 150 white portland cement.
2. Aggregates: Provide approximately 65 percent ASTM C 33 white limestone quartz, and approximately 35 percent ground marble, granite or other sound stone to provide colors required.
3. Concrete Mixture:

    a. Compressive Strength: 4000 psi minimum.
    b. Absorption: 7 percent maximum.

c. Air Entrainment: 4 to 6 percent.

4. Reinforcing: Uncoated-Steel Reinforcing Bars, ASTM A 615, Grade 60; and ASTM A 1064 galvanized welded wire fabric. Provide at least 2 longitudinal bars and wire mesh cage for each unit, unless indicated otherwise.
5. Reinforcing: Epoxy-Coated Reinforcing Bars, ASTM A 615 and ASTM A 775, Grade 60, for use where indicated; and ASTM A 1064 galvanized welded wire fabric. Provide at least 2 longitudinal bars and wire mesh cage for each unit, unless indicated otherwise.
6. Finish: Light sand blast finish and custom colors to match existing stone sills.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

D. Aggregate for Grout: ASTM C 404.

E. Water: Potable.

2.6 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mixing: 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, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S or Type N.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.7 REINFORCEMENT

A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.

B. Uncoated-Steel Reinforcing Bars: ASTM A 615, Grade 60.

C. Epoxy-Coated Reinforcing Bars: ASTM A 615 and ASTM A 775, Grade 60, for use where indicated.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Acceptable Products: Corelock, by Wire-Bond or acceptable equivalent.

E. Horizontal Joint Reinforcing: Provide welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner ("L") and intersecting ("T") units. Fabricate from cold-drawn steel wire ASTM A 1064, with deformed continuous side rods and plain cross rods, into units with widths of approximately 2 inches less than nominal width of walls and partitions as required to position side rods for mortar coverage of not less than 5/8- inch on joint faces exposed to exterior and not less than 1/2- inch elsewhere. Provide ladder type of joint reinforcing with cross rods spaced at not more than 16 inches o.c.

1. Wires: Fabricate with 0.148- inch diameter side and cross rods, hot-dip galvanized after fabrication to comply to ASTM A 153, Class B-2 coating. Fabricate with 0.187- inch diameter eye sections for masonry veneer anchors, where required, hot-dip galvanized after fabrication to comply to ASTM A 153, Class B-2 coating.
2. Number of Side Rods:

a. Single pair for single wythe masonry.
b. Double pair for double wythe interior walls.

3. Dual eye section for masonry veneer anchors welded to joint reinforcing prior to galvanizing. Size to have pintle section at the outer face of the cavity wall insulation, where applicable.

a. H&B "170 Truss Lox-All Adjustable Eye-Wire", or approved equal.

2.8 TIES AND ANCHORS

A. Masonry Veneer Anchors: Two-piece assemblies which permit vertical or horizontal differential movement between wall and framework or backup parallel to plane of wall, but resist tension and compression forces perpendicular to plane of wall; consisting of wire tie section that hooks into truss rod joint reinforcing in the CMU backup, anchors welded to structural steel, a metal anchor section screwed to metal studs over sheathing, or a galvanized steel plate bolted to concrete foundation walls. Comply with the following requirements:

1. Wire: ASTM A 1064 carbon steel, 0.187- inch min. diameter prior to coating, galvanized finish as specified below.
2. Wire Tie Shape: Rectangular.
3. Wire Tie Length: As required to extend within 1- inch of masonry veneer face.
4. Sheet Metal: ASTM A 1008 cold rolled carbon steel, minimum thickness of 0.105- inch (12 ga.) prior to coating, hot-dip galvanized ASTM A 153, Class B-2 coating.
5. Metal Stud Anchor Section: 0.105- inch, galvanized carbon steel bent plate with reinforced deformations and 1/4- inch holes for anchoring to metal studs with two corrosion resistant screws. Size to allow wire ties to engage plate at face of insulation.
6. Concrete Foundation Wall Anchor Section: 0.105- inch, galvanized carbon steel bent plate with reinforced deformations for anchoring to concrete or in-place grouted masonry walls with a stainless steel post-installed anchor. Size to allow wire ties to engage plate at face of insulation. Intended for use over waterproofing membrane or as a post-installed anchor.
7. Screw-Type Tie Barrel: ASTM C 954 (1000-hour polymer coating), ASTM A 510. Stainless steel to ASTM A 580.
8. Available Products: Subject to compliance with requirements, masonry veneer anchors which may be incorporated in the work include, but are not limited to, the following:

a. Concrete Foundation Wall: H&B "HB-213 Adjustable Veneer Anchor" or equal.
b. CMU backup: H&B "170-ML Truss Adjustable Eye-Wire" or equal.
c. Metal Stud: H&B "HB-213 Adjustable Veneer Anchor" or equal.
d. Structural Steel: H&B "VBT – Vee Byna-Tie" and "359-FH Weld-On Tie" or equal.
e. Integrated Insulated Composite Backup Panel System: Manufacturer's approved integral panel clip and masonry anchor for the panel system.

1) Provide H&B "2-Seal Concrete Tie" or approved equal at locations shown in contract documents and at locations where

manufacturer's integral panel clip and anchor will not work with masonry veneer coursing.

9. Post-Installed Fasteners for Concrete or Grouted CMU: Stainless steel expansion anchors as manufactured by HILTI, or approved equal. Size to comply with ASTM E 488 to sustain, without failure, a load equal to 6 times the imposed load.
10. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank.

B. CMU Anchors: Two piece galvanized steel anchors for anchoring concrete masonry unit walls to structural steel. Anchors shall permit differential vertical movement and shall resist movement in tension and compression away from wall or column. Comply with the following:

1. Wire Size: 0.187- inch min. diameter, prior to coating.
2. Finish: Hot Dip Galvanized Coating, ASTM A 153, Class B-2 coating.
3. Column Anchors: Triangular ties, H&B "VBT – Vee Byna-Tie" and "359-FH Weld-On Tie" or equal
4. Beam Anchors: Sliding rod type to be welded to underside of beam, "PTA 420 Partition Top Anchor" by H&B or equal. Lower portion of anchor shall be embedded in CMU head joint.

C. Wire Ties For Intersecting Walls: Rectangular wire ties with closed ends and not less than 4 inches wide, except that 3 inches wide ties may be used for 4 inch walls. Fabricate from ASTM A 1064 carbon steel, 0.187- inch min. diameter prior to coating, galvanized finish complying with ASTM A 153, Class B-2.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch thick.
2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
7. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
8. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two layers of polymeric fabric with non-asphaltic adhesive. Use only where flashing is fully concealed in masonry.

    a. Basis of Design: "Multi-Flash 500" by York Manufacturing, Inc., or approved equal.
    b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50.
3. Elastomeric Sealant: Silyl-terminated polyether (STPE) joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT; unless recommended otherwise by the flashing manufacturer.

    a. Basis of Design: "UniverSeal US-100" by York Manufacturing, Inc.

E. Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Termination Bars for Flexible Flashing: Stainless-steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.10 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 or urethane.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated. H&B "RS Series – Rubber Control Joint" or approved equal.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.11 MASONRY CLEANER

A. Job-Mixed Detergent: Solution of Calgon trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

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.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Do not wet concrete masonry units.

3.3 TOLERANCES

A. Comply with tolerances in TMS 602/ACI 530.1/ASCE 6 and the following:

1. Maintain alignment and relative position with exposed structural steel adjacent to masonry to within plus or minus 1/8- inch.
2. For conspicuous vertical lines, such as external corners, door jambs, reveals, expansion joints, and control joints, do not vary from plumb by more than 1/4-inch in 20 feet, nor 1/2- inch maximum.
3. For vertical alignment of head joints, do not vary from plumb by more than 1/4- inch in 10 feet, nor 1/2- inch maximum.
4. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4- inch in 20 feet, nor 1/2- inch maximum.
5. 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.
6. 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 thickness by more than 1/8- inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4 inch horizontal face dimensions at corners or jambs.

C. Lay up walls plumb and with courses level, accurately spaced and coordinated with other work.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; 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 construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. 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.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated

I. Non-Loadbearing Interior Partitions: Build full height of story to underside of solid structure above, unless otherwise indicated. Leave 1- inch clear space between masonry and

underside of structure for installation of firestopping unless indicated otherwise. Coordinate installation with bracing.

1. Bond intersecting walls together, or provide wire ties spaced at 16 inches on center vertically installed in grouted CMU cores. Omit wire ties at expansion joints and control joints.
2. Rake out joints and apply sealant at junction of masonry with other construction.
3. Provide horizontal joint reinforcement at every other course of CMU walls as specified herein.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Remove masonry units disturbed after laying; clean and re-lay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4- inch or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, or air barriers unless otherwise indicated.

G. Rake back exterior head joints at precast concrete sill units 1/4- inch to allow for installation of sealant. Sealant and bond breaker tape shall be installed to comply with requirements of Section 079200.

3.6 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 that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: 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 TMS 602/ACI 530.1/ASCE 6 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.

3.7 HORIZONTAL JOINT REINFORCING

A. Provide continuous horizontal joint reinforcing in all concrete masonry assemblies and elsewhere as indicated. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8- inch on exterior side of walls and 1/2- inch at other locations. Lap reinforcement a minimum of 6 inches. Do not bridge control and expansion joints with reinforcing. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets and other special conditions.

B. Space continuous horizontal reinforcing at 16 inches o.c. vertically in all CMU walls, starting at the first block to block joint.

C. At openings greater than 12 inches wide, place additional reinforcement in 2 horizontal joints 8 inches apart above and below opening, extend 24 inches beyond jambs except at control joints.

3.8 ANCHORING MASONRY WORK

A. General: Provide anchor devices of type indicated. Anchor all masonry veneers with specified anchors. Space anchors at no more than 16 inches on center, horizontally and vertically.

B. Anchor masonry veneer to the backup wythe at all cavity wall assemblies, complying with the following:

1. Provide adjustable metal pintle ties to engage eye sections of horizontal joint reinforcing in backup wythe.
2. Embed tie section in masonry joints. Ties shall extend to within 1- inch of face of masonry.
3. Locate tie section relative to course in which eye section is embedded to allow vertical differential movement of tie up and down in accordance with manufacturer's recommendations.
4. Space ties as indicated, but no more than 16 inches o.c. vertically and 16 inches o.c. horizontally. Install additional ties within 12 inches of openings and at intervals around perimeter or openings not exceeding 16 inches.

C. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide anchoring devices of type required to fit anchors furnished on structural steel beam webs.
2. Anchor masonry to structural steel columns with 2 piece anchors welded to columns where indicated.

D. Anchor single wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements.

1. Fasten each anchor section through sheathing to metal studs with two metal fasteners of type indicated.
2. Embed tie section in masonry joints. Provide not less than 1/2- inch air space between back of masonry veneer wythe and face of sheathing.
3. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
4. Space anchors as indicated but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally. Install additional anchors within 12 inches of openings and at intervals around perimeter or openings not exceeding 16 inches.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Provide vertical expansion and control joints in masonry where shown. If control joints are not shown for masonry walls, provide control joints per Architect's field sketch. Control joint spacing shall be no more than 32 feet o.c. for interior walls and no more than 28 feet o.c. for exterior walls, unless indicated otherwise.

1. Submit proposed locations to the Architect.

C. Refer to Section 079500 for metal expansion joint covers.

D. Provide continuous preformed control joint gaskets in sash block at all CMU control joints.

E. Provide compressible joint filler in masonry veneer and other locations where indicated at all control and expansion joints.

F. Exterior and interior face of all joints shall be sealed per Section 079200 "Joint Sealants." (Joint width for sealants: 3/8- inch unless otherwise indicated).

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

D. Provide flashing and weepholes above all lintels in exterior walls as specified herein.

3.11 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep vents in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep vents in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 REPAIRING, 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, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

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 set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape holes or chisels.
2. Test cleaning methods on sample wall panel. Leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water prior to applying cleaners; remove cleaners promptly by rinsing thoroughly with clean water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean stone trim to comply with stone supplier's written instructions.
8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

E. Slate Stools and Trim: Sponge down exposed surfaces during installation to prevent mortar stains from forming. Wash water should be kept clean by frequent changing. All mortar stains should be cleaned from slate within 24 hours of its installation. After slate has been set for a minimum of 14 days, scrub with a manufacturer approved detergent or cleaning agent, followed by a thorough rinsing with clean water.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

PART 1. GENERAL

1.1. RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 055213 "Pipe and Tube Railings" for pipe and tube railings.
3. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.

1.2. SUMMARY:

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.

1.3. PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

C. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor is 1.5.

1.4. ACTION SUBMITTALS:

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Paint products.
3. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5. INFORMATIONAL SUBMITTALS:

A. Qualification Data: For qualified professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.

1. Test railings according ASTM E 894 and ASTM E 935.

1.6. QUALITY ASSURANCE:

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7. COORDINATION:

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2. PRODUCTS

2.1. METALS, GENERAL:

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2. FERROUS METALS:

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.3. FASTENERS:

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4. MISCELLANEOUS MATERIALS:

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

G. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

H. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.5. FABRICATION, GENERAL:

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6. STEEL-FRAMED STAIRS:

A. 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:

1. Alfab, Inc.
2. American Stair, Inc.
3. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel channels.

    a. Provide closures for exposed ends of stringers.

2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Shape metal pans to include nosing integral with riser.
4. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.7. STAIR RAILINGS:

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

2.8. FINISHES:

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3. EXECUTION

3.1. INSTALLATION, GENERAL:

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2. ADJUSTING AND CLEANING:

A. Touchup 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 to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099100 Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

PART 1. GENERAL

1.1. RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Section 055100 "Metal Stairs" for steel tube railings included with metal stairs.
2. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.

1.2. SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

1.3. PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.
2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
3. Stainless Steel: 60 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4. ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5. INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.6. QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7. PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8. COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2. PRODUCTS

2.1. MANUFACTURERS

A. 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:

1. Steel Pipe and Tube Railings:

a. Pisor Industries, Inc.
b. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2. METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3. STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed).

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4. FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.5. MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with Section 099100 “Painting.”

E. Intermediate Coats and Topcoats: Provide products that comply with Section 099100 "Painting"

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.6. FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

J. Form changes in direction as follows:

1. By bending or by inserting prefabricated elbow fittings.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to

structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7. FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. 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.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8. STEEL AND IRON FINISHES

A. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.

PART 3. EXECUTION

3.1. EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2. INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3. RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4. ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.5. ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099100 "Painting".

3.6. PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

1.1 SUMMARY

A. Section Includes:
   1. Wood blocking and nailers.
   2. Wood furring.
   3. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.

F. Lumber grading agencies, and abbreviations used to reference them, include the following:

   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.
   4. WCLIB: West Coast Lumber Inspection Bureau.
   5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.
8. Sill sealer gasket/termite barrier.

C. Qualification Statements: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.

4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:

1. Boards: 15 percent.

2. Dimension Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.
3. Timber. 19 percent.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. 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.

2.2 FIRE-RETARDANT TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

G. Concealed blocking.

H.

2.3 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1,] in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.5 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
2. For pressure-preservative-treated wood, use stainless steel fasteners.
3. For redwood, use brass/bronze fasteners.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.

2.6 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleveland Steel Specialty Co.
2. MiTek Industries, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. Tamlyn.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304 or Type 316.

1. Use for exterior locations and where indicated.

2.7 MISCELLANEOUS MATERIALS

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. 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.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully 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. Drive nails snug but do not countersink nail heads unless otherwise indicated.

M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.

2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 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.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Rough Carpentry: Section 061000.

1.2 REFERENCES

A. Comply with the applicable provisions of the "Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program" (Fifth Edition) of the Architectural Woodwork Institute (AWI) except as otherwise specified herein. References to "Premium", "Custom" and "Economy" Grades herein, shall be as defined in that Standard.

1. Lumber Standard: AWI Section 100.

2. Lumber Standard; American Softwood Lumber Standard: U.S. Dept. of Commerce Product Standard PS-20.
3. Panel Products: AWI Section 200.
4. Preservative Treatment Standard: American Wood Preservers Bureau (AWPB), by the American Wood Preservers Institute (AWPI).

1.3 DESCRIPTION OF WORK

A. Definitions: Finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of other sections.

B. Types of finish carpentry work in this section include but are not necessarily limited to the following:
1. Wood benches
2. Miscellaneous finish carpentry and trim

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

B. Sample Warranty: For manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

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.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Maintain constant minimum temperature of 60 degrees F and maximum relative humidity of 55 percent in spaces to receive the Work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Low-Emitting Materials: Composite wood products 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."

B. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."

2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

D. Hardboard: AHA A135.4.

E. MDF: ANSI A208.2, Grade 130 made with binder containing no urea-formaldehyde resin.

F. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

G. General:

1. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.
2. Moisture Content of Softwood Lumber: Provide seasoned (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the application grading rules of the respective grading and inspecting agency for the species and product indicated.
3. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation with the ranges required in the referenced woodworking standard.
4. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.

H. Interior Finish Carpentry:
1. Interior Trim for Transparent Finish: Plain sawn Red Oak, manufactured to sizes and patterns (profile) shown from selected First Grade Lumber (NHLA).
2. Hardwood Veneer Plywood : Provide Manufacturer's stock hardwood panels complying with applicable requirements of PS 51 for species and grade of face veneers and backing, adhesive, construction, thickness, panel size, and finish.

a. Face Veneer Species: Plain sliced Red oak, Good grade.
b. Backing Veneer Species: Same species and grade as face veneer.
c. Construction: 7 ply veneer core.
d. Thickness: 3/4", unless otherwise noted.
e. Plywood Type (Water Resistance Capability): Type II (Interior)
f. Finish: Sanded.

I. Miscellaneous Materials:

1. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition wood material to average prevailing humidity conditions in installation areas prior to installing.

3.2 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, not adequately seasoned or to 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. Install the work plumb, level true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'0" for plumb and level countertops; and with l/16" maximum offset in flush adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

E. Wainscot and Cabinets: Install without distortion so that doors will fit openings properly and be accurately aligned. Adjust hardware to center doors in openings and to provide unencumbered operation. Complete the installation of hardware items as indicated.

F. Wood Storage Shelving: Complete the assembly of units and install in the areas indicated, including hardware.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTIONS

A. Repair damage and defective finish carpentry work whenever possible to eliminate defects functionally and visually; where not possible to repair property, replace woodwork. Adjust joinery to uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces ready for field applied finishes.

END OF SECTION

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Mineral-wool blanket.
3. Sound Attenuation Fire Blanket Insulation (S.A.F.B.).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.6 FIELD CONDITIONS

A. Do not proceed with the installation of insulation on walls or under slabs until the Work which follows (and which conceals the insulation) is ready to be performed.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV - "RXP": ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Basis of Design Product: Owens Corning; FOAMULAR 250.
2. Minimum Thermal Resistance (R-Value): R-5.0 per inch.
3. Applications: As indicated on the Drawings.

2.2 MINERAL-WOOL BLANKET

A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Basis of Design Product: Owens Corning; Thermafiber UltraBatt Unfaced.
2. Applications: As indicated on Drawings.

2.3 SOUND ATTENUATION FIRE BLANKET INSULATION

A. Sound-Attenuation Fire Blankets – "SAFB": ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Basis of Design Product: Johns Manville; MinWool SAFB Insulation.
2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.4 ACCESSORIES

A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

B. Mechanical Anchors: Type and size shown or, if not shown, as recommended by the insulation manufacturer for the type of application shown and condition of substrate.

C. Z-Shaped Furring: Galvanized steel ASTM A 653/A 653M G60, nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated; designed for mechanical attachment of insulation boards to monolithic concrete or concrete masonry walls.

1. Fasteners for Furring Members: Type and size recommended by furring manufacturer for the substrate and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the substrate and the conditions under which the insulation Work is to be performed. Do not proceed with the insulation Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications. If written instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction.
    b. Interior Walls: Set units with facing placed toward areas of high humidity.

7. Installation of vapor retarders on framing:

    a. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates.
    b. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
    c. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
    d. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

3.5 PROTECTION

A. Protect installed insulation 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.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Water-drainage exterior insulation and finish system (EIFS).

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.

2. Water-resistive barrier coatings.

B. Related Requirements:

1. Section 092900 "Gypsum Board Assemblies" for Glass-Mat Gypsum Sheathing

1.2 DEFINITIONS

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. IBC: International Building Code.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistive barrier coatings.

B. Shop Drawings

C. Samples: Submit 8-inch square samples for review in field against existing building stucco. For each exposed product and for each color and texture specified.

D. Samples for Verification: After selection of color and texture, submit 24-inch- (600-mm-) square panel prepared using same tools and techniques intended for actual work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:

1. EIFS complies with requirements.
2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
3. Accessory products installed with EIFS, including joint sealants, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Product Test Reports: For each EIFS assembly and component, and for water-resistive barrier coatings, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engaged in application of similar systems for a minimum of three (3) years
2. Experienced with installation and handling of EIFS manufacturer's products.
3. Employ skilled mechanics who are experienced and knowledgeable in air and water-resistive barrier and EIFS application, and familiar with the requirements of the specified work
4. Successful completion of minimum of three (3) projects of similar size and complexity compared to the specified project
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with Sto's published specifications and details and the project plans and specifications

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:

a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
b. Insulation installed as part of EIFS.
c. Insulation adhesive and mechanical fasteners.
d. EIFS accessories, including trim components and flashing.
e. Water-resistive barrier coatings.
f. EIFS drainage components.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

A. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

B. Basis of design Manufacturer: Sto Corp., 3800 Camp Creek Parkway, Building 1400, Suite 120, Atlanta, GA 30331 Tel: 800 221 2397, www.stocorp.com

C. Substitutions in accordance with Section 016100

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.

2. Ultimate wind load capacity of plus or minus 188 psf (9.00 kPa) when measured in accordance with ASTM E330, and support wall construction achieves equal or greater ultimate load capacity.

3. Impact Performance: ASTM E2568, Ultra High impact resistance unless otherwise indicated.
4. No mold growth at 60 days when measured in accordance with ASTM D3273
5. Drainage Efficiency: 95 percent average minimum when tested in accordance with ASTM E2273.

6. Flame spread and smoke development of lamina (base coat, reinforcing mesh, and finish) less than 25 and 450, respectively, when tested in accordance with ASTM E84
7. Meets acceptance criteria of NFPA 285 for use on non-combustible construction

2.3 EIFS MATERIALS

A. EIFS System: StoTherm® ci as manufactured by Sto Corp. Provide complete system including all components recommended by manufactured for complete functioning system

B. Water-Resistive Barrier Coating: EIFS manufacturer's standard formulation and accessories for use as water-resistive barrier coating; compatible with substrate.

1. Water-Resistance: Comply with physical and performance criteria of ASTM E2570/E2570M.
2. Basis of design: StoGuard

C. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with the following:
1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.

E. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
1. Dimensions: Provide insulation boards of not more than 24 by 48 inches (610 by 1219 mm), with thickness indicated on Drawings.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) in accordance with ASTM E2098/E2098M and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.

a. Provide Sto Mesh and Sto Armor Mat to meet ultra-high impact resistance.
2. Detail-Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m) or as recommended by EIFS manufacturer.

G. Base Coat: EIFS manufacturer's standard mixture complying with the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.

H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

I. Finish Coat: EIFS manufacturer's trowel applied decorative and protective textured finish.

1. Provide Sto Signature or Sto Specialty finish to match texture of existing stucco parge coat.
2. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.

a. Aggregate: As required to texture of existing stucco parge coat..

3. Colors: As selected by Architect from manufacturer's full range.

4. Textures: Match texture of existing stucco parge coat.

J. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

K. Water: Potable.

L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 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. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.3 INSTALLATION OF EIFS, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 APPLICATION OF SUBSTRATE PROTECTION

A. Water-Resistive Barrier Coating: Apply over sheathing to provide a water-resistive barrier.

1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.

B. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 INSTALLATION OF TRIM

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated. Coordinate with installation of insulation.

1. Weep Screed/Track: Use at bottom termination edges, at window and door heads of water-drainage EIFS unless otherwise indicated.
2. Casing Bead: Use at other locations.

3.6 INSTALLATION OF INSULATION

A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397 and in conformance with manufacturer's written instructions.

3.7 APPLICATION OF BASE COAT

A. Base Coat: Apply full coverage to exposed insulation in conformance with manufacturer's written instructions.

B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

C. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.

D. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

1. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.8 APPLICATION OF FINISH COAT

A. Primer: Apply over dry base coat.

B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Water-resistive barrier coatings applied over sheathing.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. EIFS Tests and Inspections: In accordance with ASTM E2359/E2359M.

D. EIFS will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

SECTION 074213 - METAL COMPOSITE MATERIAL WALL PANELS

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. Section 079200, Joint Sealants.

1.2 SUMMARY

A. Section includes MCM wall panels. Uses include but are not limited to interior column enclosures.

1.3 DEFINITIONS

A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, MCM panel Fabricator and Installer, MCM sheet manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to MCM panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for MCM panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of MCM panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of MCM panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. MCM Panels: 12 inches by 12 inches.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

1. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.
2. MCM System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on MCM system type provided.

a. Dry System: Tested to AAMA 501.

C. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For MCM panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by MCM Fabricator.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on MCM panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

A. Warranty on Panel Material: Manufacturer's standard form in which manufacturer agrees to replace MCM that fails within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 MCM WALL PANELS

A. MCM Wall Panel Systems: Provide factory-formed and -assembled, MCM wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 3A Composites USA Inc.; ALUCOBOND® PLUS or comparable product by one of the following:

    a. Arconic Architectural Products (USA).
    b. Mitsubishi Chemical Composites.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, anodized aluminum sheet facings.

1. Panel Thickness: 0.157 inch (4 mm).
2. Core: Fire retardant.
3. Exterior Finish: Anodized with coats and thicknesses that comply with MCM panel manufacturer's performance and warranty requirements.

    a. Color: As selected by Architect from manufacturer's full range.

4. Peel Strength: 22.5 in-lb/in. (100 N x mm/mm) when tested for bond integrity in accordance with ASTM D1781.
5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.

C. Attachment Assembly Components: Formed from material compatible with panel facing.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of MCM panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings,

sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 3A Composites USA Inc.; ALUCOBOND® Axcent™ Trim or comparable product by one of the following:

a. Arconic Architectural Products (USA).
b. Mitsubishi Chemical Composites.

2. Aluminum Trim: Formed with 0.040-inch (1.00-mm-) thick, coil-coated aluminum sheet facings.
3. Color: As selected by Architect from manufacturer's full range.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish MCM panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. 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 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.

C. Aluminum Panels and Accessories:

1. PVDF Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating MCM panels to verify actual locations of penetrations relative to seam locations of MCM panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and MCM panel manufacturer's written recommendations.

3.3 MCM PANEL INSTALLATION

A. General: Install MCM panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving MCM panels.
2. Flash and seal MCM panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by MCM panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as MCM panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support MCM wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Panel Installation: Attach MCM wall panels to supports at locations, spacings, and with fasteners recommended by Fabricator to achieve performance requirements specified.

1. Dry Seal Systems: Seal horizontal and vertical joints between adjacent MCM wall panels with Fabricator's standard gasket system.

a. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by Fabricator. Use Fabricator's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to exterior at horizontal joints through drain tube. Attach MCM wall panels to tracks by interlocking panel edges with Fabricator's standard "T" clips.
b. Panel Installation:

1) Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
2) Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.

c. Joint Sealing: Seal all joints in accordance with AAMA 501.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete MCM panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM panel Fabricator; or, if not indicated, provide types recommended in writing by MCM system Fabricator.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Site Verifications of Conditions:

1. Verify conditions of substrate previously installed under other Sections are acceptable for the MCM system installation. Provide documentation indicating detrimental conditions to the MCM system performance.
2. Once conditions are verified, MCM system installation tolerances are as follows:

    a. Shim and align MCM wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as MCM panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of MCM panel installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

B. After MCM panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078400 - FIRESTOPPING

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.

B. Related Sections:

1. Section 092900 "Gypsum Board Assemblies" for firestop tracks for metal-framed partition heads.

1.2 SUMMARY

A. Section Includes firestopping for the following:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal (floor and roof) assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Single Source Limitations: Obtain firestopping systems for all conditions from a single manufacturer.

B. Materials from different firestopping manufacturers shall not be installed in the same firestop system or opening.

C. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

D. A manufacturer's representative shall review the project upon completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping materials to the Site in original, new unopened containers or packages bearing manufacturer's printed labels.

B. Store and handle firestopping materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, etc.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install firestopping system when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of joints, openings, and penetrating items to ensure that firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints, sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. A/D Fire Protection Systems Inc.
2. GCP Applied Technologies (formerly Grace Construction Products).
3. Hilti, Inc.
4. Nelson Firestop Products.
5. Nuco Inc.
6. RectorSeal.
7. Specified Technologies Inc.
8. 3M Fire Protection Products.
9. Tremco, Inc.
10. USG Corporation.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint and Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2.3 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. For firestopping exposed to moisture, furnish products that do not deteriorate when exposed to this condition.
2. For penetrations involving insulated piping, furnish through-penetration firestop systems not requiring removal of insulation.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.4 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.5 MIXING

A. Firestopping Materials: For those products requiring mixing before application, comply with firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joints, opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing firestopping systems, clean out joints and openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of joint substrates, opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean joint substrates, opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials for firestopping systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints, openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by joints, openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Firestopping System Identification: Identify each joint and penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. For Penetration Firestopping, the words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

2. For Joint Firestopping, the words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
3. Contractor's name, address, and phone number.
4. Designation of applicable testing and inspecting agency.
5. Date of installation.
6. Manufacturer's name.
7. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspect firestopping systems. Where deficiencies are found, repair or replace firestopping systems so that they comply with requirements.

B. Owner may engage a qualified testing agency to perform tests and inspections according to ASTM E 2174 for penetration firestopping.

1. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
2. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints and openings as the Work progresses by methods and with cleaning materials that are approved in writing by firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated on the Drawings, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Provide firestopping systems at through penetrations of fire-resistance-rated walls, horizontal assemblies, and smoke barriers, including but not limited to:

1. Voids around:

a. Metallic Pipes, Conduit, or Tubing.
b. Nonmetallic Pipe, Conduit, or Tubing.
c. Ducts.
d. Electrical Cables.
e. Cable Trays with Electric Cables.
f. Insulated Pipes.
g. Miscellaneous Electrical Penetrants.

h. Miscellaneous Mechanical Penetrants.
i. Groupings of Penetrants.
j. Structural members.

2. Other openings with no penetrating items.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
2. Butyl joint sealants.
3. Latex joint sealants.
4. Acoustic Sealants.

B. Related Requirements:

1. Through-Penetration Firestopping: Section 078400
2. Glass and Glazing: Section 088000
3. Sealants for use in floor and wall tile are specified in Section 093000 - Tile Work

1.3. ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4. INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Field-Adhesion-Test Reports: For each sealant application tested.

D. Sample Warranties: For special warranties.

1.5. QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6. FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7. WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

D. SWRI VALIDATION:

1. All sealants are to be validated by the Sealant Weatherproofing Restoration Institute. (www.SWRIONLINE.com)

PART 2 - PRODUCTS

2.1. JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Weatherproofing system shall comply with the following limits for VOC content when calculated according to 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.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside 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."

D. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project. Provide a non stain warranty.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2. SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100, T2: One-part, neutral-curing, ultra low-modulus silicone sealant; plus 100 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100, Use G, A, M, O, T2.

1. Pecora, 890NST or Architect's approved equal.

2.3. HYBRID JOINT SEALANTS

A. Hybrid STPU (silyl-terminated polyurethane) sealant: One-Part, Non-Staining, Non-Yellowing, Paintable, Hybrid Sealant. Plus and minus 50 percent movement capability. ASTM C-920, Type S, Grade NS, Class 50, Use NT, T1, G, M, A and O.

1. Pecora, Dynatrol I-XL Hybrid or Architect's approved equal

2.4. BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: Single-component; Non-skinning, Non-hardening Butyl Sealant.

1. Pecora, BA 98 or Architect's approved equal.

2.5. JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6. MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.
b. Porcelain enamel.
c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3. INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4. FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

   a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
   b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5. 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 manufacturers of joint sealants and of products in which joints occur.

3.6. PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7. JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Control and expansion joints in unit masonry.
   b. Joints between metal panels.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
   e. Control and expansion joints in ceilings and other overhead surfaces.
   f. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, Pecora 890NST.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Vertical joints on exposed surfaces of unit masonry, concrete walls and partitions.
   c. Perimeter of interior door and window frames.
   d. Joints in Gypsum wall board
   e. Other interior joints as indicated on Drawings.

2. Joint Sealant: Dynatrol I-XL Hybrid.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Concealed mastics.

4. Joint Locations:

   a. Aluminum thresholds.
   b. Sill plates.
   c. Other joints as indicated on Drawings.

5. Joint Sealant: Butyl-rubber based Pecora BA-98.

6. Joint-Sealant Color: manufacturer's Standard

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Interior standard steel frames.

B. Related Requirements:

   1. Section 087100 “Door Hardware” for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation 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.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistant ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   2. Locations of reinforcement and preparations for hardware.
   3. Details of each different wall opening condition.
   4. Details of anchorages, joints, field splices, and connections.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

D. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers offering products which may be incorporated into the work include, but are not limited to:
   1. Ceco Door; AADG, Inc.; ASSA ABLOY.
   2. Curries, AADG, Inc.; ASSA ABLOY Group.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR STANDARD STEEL FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.
   1. Frames:
      a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
      b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Full profile welded.
   2. Exposed Finish: Prime.

2.4 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.5 FRAME ANCHORS

A. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Sidelite 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 welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
   a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
   b. Install frames with removable stops located on secure side of opening.
2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with post-installed expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Solidly pack mineral-fiber insulation inside frames.

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

6. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.

B. Related Requirements:
1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Clearances and undercuts.
6. Requirements for veneer matching.
7. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratingsindicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lambton Doors.
b. Masonite Architectural.
c. Oshkosh Door Company.
d. VT Industries, Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.

a. Species: Select white birch.

b. Cut: Plain sliced (flat sliced) .
c. Match between Veneer Leaves: Book match.

d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

5. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors:
        1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
        2) Screw-Holding Capability: 550 lbf (2440 N) in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors, 20-minute fire rated doors, and 45-minute fire rated doors:

    a. WDMA I.S. 10 structural composite lumber.
        1) Screw Withdrawal, Door Face: 550 lbf (2440 N).
        2) Screw Withdrawal, Vertical Door Edge: 550 lbf (2440 N).

    b. ANSI A208.1, Grade LD-2 particleboard.
        1) Particleboard core doors are **only acceptable** where structural composite lumber core door can not meet required fire rating for size and configuration required.
        2) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and to meet Extra Heavy Duty rating specified.
7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.

3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Premium.
2. ANSI/WDMA I.S. 1A TR-8 UV Cured Acrylated Polyester/Urethane.

3. Staining: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.

4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

6. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 081540 – FRP/ALUMINUM HYBRID ENTRANCE DOORS AND ALUMINUM FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 087100 "Finish Hardware."
2. Section 088000 "Glass and Glazing."

1.2 SUMMARY

A. Section Includes:

1. FRP/Aluminum Hybrid entrance doors.
2. Aluminum frames for use with FRP/Aluminum Hybrid doors.

1.3 DEFINITIONS

A. FRP – Fiberglass reinforced polyester.

1.4 REFERENCES

A. Unless noted otherwise, the latest published edition of each reference applies:

1. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
5. ASTM E 283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
6. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
8. AAMA 1503.1 – Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
9. AAMA/WDMA/CSA 101/I.S.2/A440 – NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights.
10. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Physical Endurance for Steel Doors, Frames and Frame Anchors.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, and finish.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:

1. Finishes: For each type of exposed finish required, in manufacturer's standard sizes.

2. Fabrication:

a. FRP/Aluminum Hybrid Doors: Submit manufacturer's corner sample of door showing face sheets, core, framing, and finish.

b. Aluminum Frames: Vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1) Joinery, including fasteners.
2) Anchorage.
3) Expansion provisions.
4) Glazing.
5) Flashing and drainage.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer verifying minimum of five years of experience.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit manufacturer's maintenance and cleaning instructions for doors and frames to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Standards: Comply with the requirements and recommendations in applicable specification and standards by AAMA, except to the extent more stringent requirements are indicated.

B. Manufacturer Qualifications: Company specializing in manufacturing FRP/Aluminum Hybrid door and frame systems of the type required for this project, with minimum 25 years documented experience.

C. Instruction: The manufacturer or his representative will be available for consultation to all parties engaged in the Project including instruction to installation personnel.

D. Regulation and Codes: Comply with the current edition in force at the project location of all local, state and federal codes and regulations, including the applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

E. Single Source Responsibility: Obtain doors and aluminum frames from a single firm specializing in the type of construction required, so that there will be undivided responsibility for the specified performance of all component parts, including glazing for doors and factory installation of door hardware (except closers).

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Inspect doors and frames upon delivery for damage; unload and store with minimal handling. 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.

C. Store products of this section under cover in manufacturer's unopened packaging until installation. Place units on minimum 4-inch wood blocking. Doors and frames to be stacked in a vertical upright position with minimum 1/4-inch space between each door to permit air circulation. Remove packaging immediately if packaging becomes wet.

1.10 FIELD CONDITIONS

A. Field Measurement: Field verify all information prior to fabrication and furnishing of materials; show recorded measurements on shop drawings. Furnish and install materials omitted due to lack of verification at no additional cost to Owner.

1.11 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

1. Warranty Period: Ten years.
2. In addition, a limited lifetime warranty (while the door is in its specified application in its original installation) covering; failure of corner joinery, core deterioration, delamination or bubbling of door skin.

B. Warrant factory installed hardware is installed in accordance with the hardware manufacturer's specifications and instructions; hardware is securely mounted and, in normal usage, will not separate from the door.

1. Warranty Period: Ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Special-Lite, Inc. (Basis of Design).
2. Architects approved equal.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. General: Provide Door and framing systems designed and fabricated to comply with specified design and performance requirements, based on testing of current products.

B. FRP/Aluminum Hybrid entrance doors:

1. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

a. For a single door 3'-0" by 7'-0": Maximum air leakage of 0.58 cfm/sq. ft. at a pressure differential of 6.27 lbf/sq. ft.

2. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

a. For a single door 3'-0" by 7'-0": No evidence of water penetration at a static-air-pressure differential of 7.50 lbf/sq. ft.

3. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503.1: Maximum of 0.29 BTU/hr x sf x deg F. Minimum of 55 CRF value.
4. IBC 2603.4.1.7 – "Doors not required to have a fire protection rating: Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or steel having a base metal thickness of not less than 0.016-inch (0.4 mm) at any point." Doors must pass by independent test or meet Code.
5. FRP Face Sheet Surface Burning Characteristics:

a. Interior faces of exterior panels and both faces of interior panels: Class A, maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
b. Exterior faces of exterior panels: Class C, maximum flame-spread and smoke-developed indexes of 200 and 450, respectively, per ASTM E 84.

6. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 1,000,000 cycles.
7. Sound Transmission Class - Exterior Doors: ASTM E 90; STC rating of 25 minimum.

C. Aluminum Framing Systems:

1. Thermal Movement: Design aluminum framing systems to provide for expansion and contraction of component materials.

2. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440-08 and -11.

a. Air Infiltration, ASTM E 283, 6.24 psf (50 mph): Less than 0.01 cfm/sq. ft.
b. Water Resistance, ASTM E 331: 15.0 psf.
c. Overall Design Pressure, ASTM E 330: 75.0 psf, positive and negative.
d. Structural Test Pressure, ASTM E 330: 112.5 psf, positive and negative.

3. Thermal Performance: Tested Product Size per NFRC 100.

a. Condensation Resistance Factor (CRF), AAMA 1503.1: 74.
b. Thermal Transmittance U-Value, AAMA 1503.1: 0.32 Btu/hr-sq. ft.-F.

4. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440-08 and -11.

a. Air Infiltration, ASTM E 283, 6.24 psf (50 mph): Less than 0.01 cfm/sq. ft.
b. Water Resistance, ASTM E 331: 15.0 psf.
c. Overall Design Pressure, ASTM E 330: 100.0 psf, positive and negative.
d. Structural Test Pressure, ASTM E 330: 150.0 psf, positive and negative.

5. Thermal Performance: Tested Product Size per NFRC 100.

a. Condensation Resistance Factor (CRF), AAMA 1503.1: 77.
b. Thermal Transmittance U-Value, AAMA 1503.1: 0.33 Btu/hr-sq. ft.-F.

2.3 FRP/ALUMINUM HYBRID FLUSH DOORS

A. Basis of Design: Special-Lite, Inc.; SL-18 6-Panel Wood Grain Hybrid FRP Door.

B. Construction:

1. Door Thickness: 1-3/4 inches.
2. Stiles and Rails: Extruded aluminum with mitered corners. Provide 3/8-inch diameter tie rods top and bottom.

a. Furnish extruded stiles and rails with integral reglets on all four sides to accept face sheets. Lock face sheets into place to permit flush appearance.

3. Hardware Reinforcement:

a. Provide minimum 1/8-inch solid aluminum for all hardware attachment points. For door closers provide minimum 1/8-inch reinforcement on inside and outside faces of doors to accommodate possible through bolt attachment.

4. Manufacture doors with cutouts for required vision lites and panels.
5. Factory install vision kits and panels.

C. Face Sheet:

1. 0.120-inch thick, colonial wood grain, stained FRP sheet.
2. Attachment of face sheet.
   a. Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
   b. Use of glue to bond face sheet to core or extrusions is not acceptable

D. Cutouts: Manufacture doors with cutouts for required vision lites, louvers, and panels

E. Core:

1. Material: Poured in place polyurethane foam.
2. Density: Minimum of 5 pounds per cubic foot.
3. R-Value: 9.0 minimum.

F. Hardware:

1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
2. Factory install hardware.

2.4 ALUMINUM FRAMING

A. Thermally Broken Framing:

1. Basis of Design: Special-Lite, Inc.; SL-600TB].
2. Size: 2-inches by 6-inches.
3. Materials: Extruded Aluminum.
4. Framing Members:

   a. Closed-back, factory fabricated by frame manufacturer.
   b. Jambs, Mullions, Sills, Horizontal Intermediates, and Headers: 0.080-inch wall thickness.
   c. Lock Jambs, Hinge Jambs, and Door Headers: 0.125-inch wall thickness.
   d. Thermal Break: Fiberglass pultrusions thermal strut and pocket filler.
   e. Fabricate components for assembly using shear-block system.

5. Applied Door Stops:

   a. 0.625-inch high, with screws and weatherstripping.
   b. Pressure gasketing for weathering seal.
   c. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
   d. Minimum 1/2-inch aluminum bar reinforcement under doorstop for required hardware attachments.

6. Sealant: Apply sealant to joints before assembling frame members.
7. Joints: Secure joints with fasteners. Provide hairline butt joint appearance.

8. Hardware:

    a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
    b. Factory install hardware.

9. Anchors:

    a. Anchors appropriate for wall conditions to anchor framing to wall materials.
    b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
    c. Secure head and sill members of transom, sidelites, and similar conditions.

2.5 HARDWARE

A. General: Refer to Section 087100 for requirements for hardware items other than those indicated herein to be provided by manufacturer of FRP/Aluminum Hybrid doors.

B. Hardware, weatherstripping, and other requirements to be provided by manufacturer of FRP/Aluminum Hybrid doors:

1. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops; at other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.
2. Adjustable Astragal for Pairs of Doors: Door Manufacturer to provide and install full height recessed spring-loaded dual brush adjustable astragal on active door to allow for seasonal adjustment against air infiltration.
3. Bottom of Door: Install bottom weather bar with nylon brush weather stripping into extruded interlocking edge of bottom rail.
4. Recessed Flush Door Pulls: Factory Installed; Special-Lite, SL-86 ADA.
5. Hardware Reinforcement: Provide minimum 1/8-inch solid aluminum for all hardware attachment points. For door closers provide minimum 1/8-inch reinforcement on inside and outside faces of doors to accommodate possible through bolt attachment.

2.6 VISION LITES

A. Provide manufacturer's standard flush glazing system of recessed channels and captive glazing gaskets or applied stops as shown.

1. Design system for replacement of glass.
2. Allow for thermal expansion on exterior units.
3. Provide means for drainage of water and condensation which may accumulate in members of door units.
4. All units shall be dry glazed with screw applied extruded aluminum stops and EPDM gaskets. Stops to be finished to match perimeter door rails.

B. Provide Rectangular Lite, size as indicated on drawings, with applied muntins as shown.

2.7 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of finish indicated.

1. Extrusions: ASTM B 221.
2. Sheet and Plate: ASTM B 209.

B. Fasteners:

1. Material: Aluminum, 18-8 stainless steel or other non-corrosive metal.
2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

C. Glazing Gaskets for Aluminum Framing: Installed in captive assembly of glazing stops.

1. EPDM: ASTM D 2000.
2. Closed-Cell Foam: ASTM D 1667.

2.8 FABRICATION

A. General: Fabricate work to be rigid and free of defects. Accurately form to required sizes and profiles.

B. Assembly:

1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges and ease edges and corners to a radius of approximately 1/64-inch.
3. Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site. Disassemble components only as necessary for shipment and installation.

    a. All hardware, with the exception of door closers, thresholds, and weatherstripping, to be shipped to door manufacturer. Door manufacturer shall install hardware on doors.
    b. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
    c. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work in manner which prevents damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

4. Reinforcing: Install reinforcing as necessary for performance requirements.
5. Separate dissimilar metals with bituminous paint or other separator to prevent corrosion.
6. Fasteners: Conceal fasteners wherever possible.
7. Fit: Maintain continuity of line and accurate relation of planes and angles; secure attachments and support at mechanical joints with hairline fit at contacting members.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M10C12C22A44, Class I, 0.7 mils (0.018 mm) or thicker.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

A. Prior to installation, check openings for squareness, alignment, twist, and plumbness.

B. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

3.3 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of door and frame systems. Install exterior doors to be weathertight in closed position.

B. Set units plumb, level, and true to line, without warp or rack of framing members or doors.

C. Anchor frames securely to adjacent construction in strict accordance with recommendations and approved shop drawings and within tolerances specified in manufacturer's instructions.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

E. Fit doors accurately in frames within clearances specified below. Shim as necessary.

1. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
2. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

F. Install sill flashing to make frame watertight at sill.

G. Set thresholds and sill members in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants" to provide weathertight construction.

H. Glazing: Comply with installation requirements in Section 088000 "Glass and Glazing" and with FRP/Aluminum door and aluminum frame manufacturer's written instructions.

I. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

J. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUST AND CLEAN

A. Adjust operating hardware to function properly, without binding, and to provide tight fit at contact points and weatherstripping.

B. Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from glass and aluminum surfaces.

C. Return to building in approximately one year and readjust all operating hardware as necessary to function properly and smoothly.

3.5 PROTECTION

A. Protect installed doors and frames to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 079200 "Joint Sealants."
2. Section 088000 "Glass and Glazing."

1.2 SUMMARY

A. Section includes aluminum windows for exterior locations of the following type(s):

1. Casement windows.
2. Horizontal rolling/sliding windows.
3. Fixed windows.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

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 and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify size and construction at existing openings for aluminum windows by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Windows: 10 years from date of Substantial Completion.
b. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Performance Class: AW.
2. Performance Grade: As indicated in Article 2.2 for each window type.

C. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.38 Btu/sq. ft. x h x deg as determined according to NFRC 100.
2. Thermal Transmittance (U-factor): Operable units shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
3. Provide CMA Bid report with initial submittals on the Project to verify Final CMA Label Certificate will comply with NYS Code and Project specifications.

D. Maximum Air Leakage Rate: 0.10 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft.; tested per AAMA/WDMA/CSA 101/I.S.2/A440.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a minimum CRF of 45.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of

components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.2 WINDOW MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide thermal break type window units by one of the following:

1. Horizontal Rolling/Sliding Windows:

a. Kawneer Series 8400TL Thermal Windows, Model 8470TL Horizontal Sliding Window conforming to HS-AW70 specifications.
b. Architect's approved equal.

2. Fixed Windows:

a. Kawneer Series 8400TL Thermal Windows, Model 8410TL Fixed Window conforming to AW-PG100-FW specifications.
b. Architect's approved equal.

2.3 MATERIALS

A. Aluminum Extrusions: All frame and sash sections shall be extruded aluminum shapes produced from commercial quality 6063-T5 or 6063-T6 alloy and shall be free from defects impairing strength and/or durability.

B. Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors and other components of window units.

1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125- inch thick, reinforce interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.
2. Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal.
3. Provide Phillips flat-head machine screws for exposed fasteners.

C. Anchors, Clips and Window Accessories: Depending on strength and corrosion-inhibiting requirements, fabricate units of aluminum, non-magnetic stainless steel, or hot-dip zinc coated steel complying with ASTM A 123/A 123M.

1. Use plastic or non-ferrous metal shim if required. Wood shims are not acceptable.

D. Compression Glazing Strips: At manufacturer's option, provide molded neoprene, molded PVC, or molded expanded neoprene gaskets.

E. Weatherstripping, Sliding Windows: All sashes shall be double weatherstripped using silicone-treated pile with a polypropylene center fin conforming to AAMA 701.2.

F. Weatherstripping, Operable Windows: Operating ventilators shall have double Santoprene thermo-plastic rubber weatherstripping around the entire perimeter.

G. Sealant: For sealants required within fabricated window units, provide type recommended by window manufacturer for joint size and movement, to remain permanently elastic, non-shrinking and non-migrating.

H. Aluminum Wire Fabric (Insect Screen): 18- by 16- mesh of 0.011-inch- diameter, coated aluminum wire. Secured by vinyl spline to a nominal 5/16- by 1-1/4-inch by 0.050-inch extruded tubular aluminum frame.

2.4 ALUMINUM WINDOW TYPE (OPERATION)

A. General: Drawings indicate which panels of each window unit are operable and which are fixed.

B. Casement Windows: Units containing side-hinged or side-pivoted vent sash as indicated, requiring the following equipment and hardware:

1. Roto-type operators and hook/cam-type latch and lever.
2. Extension hinges or pivots (non-friction type), two per sash, to provide access for cleaning.
3. Provide 90 percent swing hinges at all casement rescue windows. Rescue windows shall be operational from the inside of the room without the use of key, tool, or force greater than that which is required for normal operation of rescue windows.

C. Horizontal Sliding Windows: Units containing one or more horizontally sliding sash; requiring track for horizontal movement, with rollers in sash to provide ease of operation, with combination pull and latch unit which will prevent removal of sash when latched.

1. Each operating sash shall operate on two height adjustable ball bearing rollers capable of supporting a load of 100 lbs.; each under continuous operation.
2. Operating sash shall have an all-metal spring-loaded lock that automatically engages a white bronze keeper at meeting rails. Lock shall be easily serviceable in the field without disassembling the sash.
3. Operating sash to have anti-take out hardware for sash removal by authorized personnel only.
4. Frame head to be fitted with a removable extruded vinyl stop that limit sash travel to 6- inches or as shown on contract documents except for Emergency Rescue Windows.

D. Fixed Aluminum Windows: No operating hardware or equipment is required.

2.5 FABRICATION

A. General: Provide manufacturer's standard fabrication and accessories which comply with indicated standards and are reglazable without dismantling of sash framing. Include complete system for assembly of components and anchorage of window units.

B. Thermal-Break Construction: Fabricate aluminum window units with an integrally concealed low conductance thermal barrier, located between exterior materials and window members exposed on interior, in manner which eliminates direct metal-to-

metal contact. Provide manufacturer's standard construction which has been in use on similar window units for period of not less than five years, has been tested to demonstrate resistance to thermal conductance and condensation, and has been tested to show adequate strength and security of glass retention.

C. Glaze aluminum windows in the factory.

1. Glazing: Comply with installation requirements in Section 088000 "Glass and Glazing."
2. Provide means for drainage of water and condensation which may accumulate in members of window units.

D. Weatherstripping: Provide compression-type weatherstripping at perimeter of each operating sash, except provide sliding weatherstripping at all locations where sash rails slide horizontally along frame or units.

1. All weatherstripping shall be held in extruded ports and secured to prevent loss when operating sash.

E. Mullions: Provide mullions and cover plates, 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. Provide mullions and cover plates capable of withstanding design wind loads of window units.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

G. Emergency Rescue Windows:

1. Windows shall be of such size and design that will permit and facilitate emergency egress through them. Window hardware shall be a maximum of 54- inches above the floor.
2. The minimum clear opening area for such windows shall be at least 6 square feet and the minimum dimension shall be 24 inches unless otherwise approved.
3. Screens for rescue windows shall be hinged or sliding and shall be operable from the inside with one hand, and without the use of a key or other device.
4. One window in each teaching area shall be marked by an appropriate sign identifying the rescue window. Coordinate with Drawings.
5. Rescue window labels:

a. Bright yellow background with black letters.
b. Size: 3 inches by 5 inches.
c. Text: “Rescue Window” readable from each side of the window.
d. Window coverings/treatments must also have labels.
e. Provide window operating instructions if not readily apparent.

2.6 ACCESSORIES

A. Provide insect screen unit for each operable exterior sash. Locate screen units on either inside or outside of sash, depending upon window type. Where possible, design window units and hardware to accommodate screens in a tight-fitting removable

arrangement, with a minimum of exposed fasteners and latches, and without necessity of wickets for hardware access.

1. Fabricate screen frames of either extruded or formed aluminum tubular-shaped members of 0.040- inch minimum wall thickness with mitered or coped joints, concealed fasteners, and removable PVC spline screen anchor. Finish frames to match windows.

B. Dividers (False Muntins): Provide extruded-aluminum divider grilles in designs indicated for each sash lite.

1. Type: Permanently located at exterior lite and Permanently located between insulating-glass lites.
2. Pattern: As indicated on Drawings.
3. Profile: As selected by Architect from manufacturer's full range.

C. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

D. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

F. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

G. Glazing/Beauty Bead: Window shall be fastened to opening directly through the interior frame. Glazing/beauty bead shall snap into frame to cover fastening screws and provide seamless finish.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural

Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Existing windows shall not be removed until new replacement window is available and ready for immediate installation.

B. Do not leave window openings unprotected overnight. Install temporary closures, if necessary, to provide adequate security and weather protection.

3.2 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Windows shall be erected by skilled craftsmen in prepared openings in accordance with manufacturer written instructions and approved shop drawings. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Fiberglass insulation shall be compressed between new window frame and existing construction, or between frame and new blocking as applicable.

F. Exterior joints between windows and surrounding construction shall be sealed per specifications and approved shop drawings.

G. 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 the temperature is below sealant manufacturer recommendations.

H. Set sill members and other members in bed of compound to provide weathertight construction. Refer to Section 079200 for compounds and fillers to be installed with window units.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

3.5 ADJUST AND CLEAN

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

E. The general contractor shall be responsible for protection of the work from damage by other trades and for final cleaning.

END OF SECTION

SECTION 085850 – ALUMINUM SLIDING SERVICE WINDOW

PART 1. GENERAL

1.1. RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Section 088000 – Glazing

1.2. SUMMARY:

A. This section includes:

1. Aluminum, heavy-duty commercial sliding service windows for interior application.

1.3. SUBMITTALS:

A. Product Data: Submit Manufacturer's technical product data to illustrate materials, connections, and finishes.

B. Shop drawings: Submit for fabrication and installation of windows. Include details, elevations and installation requirement of finish hardware and cleaning.

1.4. DELIVERY, STORAGE, AND HANDLING:

A. Deliver windows crated to provide protection during transit and job storage.

B. Inspect windows upon delivery for damage. Remove damaged parts from job site.

C. Store windows at building site under cover in dry location.

1.5. PROJECT CONDITIONS:

A. Field measurements: Check opening by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

PART 2. PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering access doors include, but are not limited to, the following:

1. C.R. Laurence Co., Inc.
2. Architect approved equal

2.2. MATERIALS:

A. Provide CRL "SCDW" Series Service Window as manufactured by C.R. Laurence Co., Inc.

1. Sections: Heavy duty extruded aluminum 6063-T6. Frame has a narrow depth of 4 1/2". Center siteline has narrow 1 1/2" frame.
2. Window: top rail, bottom rail, center and end stiles 15/16". Weather proof poly-pile provided as indicated. Thumbturn lock included
3. Mechanics: heavy duty ball bearing carrier for sliding window
4. Glazing: 3/8-inch School Guard Laminated security glass (Glass Type LG per spec section 088000).
5. Finish: As selected by owner

PART 3. EXECUTION

3.1. INSTALLATION:

A. Install window in accordance with manufacturer's printed instructions and recommendations

B. Install glazing.

3.2. ADJUSTING:

A. Adjust Inspect window to provide smooth operation.

3.3. CLEANING:

A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

3.4. PROTECTION:

A. Protect window for the remainder of the construction period.

END OF SECTION

SECTION 087100 - FINISH HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. Section Includes:

1. Extent of finish hardware required is indicated on drawings and in schedules.
2. Field verification, preparation, and modification of existing doors and/or frames to receive new door hardware.

B. Types of finish hardware include (but are not necessarily limited to) the following items:

1. Closers.
2. Cylinder Cores and Keys (Permanent Cores shall be provided by Owner).
3. Cylinders
4. Door Stops and Holders.
5. Exit Devices.
6. Hinges.
7. Kick Plates.
8. Lock and Latch Sets.
9. Overhead Holders.
10. Push-Pull Units.
11. Silencers.
12. Thresholds.
13. Weatherstripping.

C. Regulatory Requirements: Comply with New York State Education Department 1998 Edition of the Manual of Planning Standards, Section S105 – Door Hardware, and NFPA 101-Life Safety Code.

1.3 QUALITY ASSURANCE

A. Manufacturer: Obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer unless the manufacturer does not offer a specific type of product specified.

B. Supplier: A recognized Architectural finish hardware supplier who has been furnishing hardware in this project's vicinity for not less than 3 years and who is or employs an experienced hardware consultant.

C. Fire-Rated Door Assemblies: Provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10c, unless otherwise indicated.

D. Smoke and Draft-Control Door Assemblies: Provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ADA accessibility guidelines and ICC A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
   a. Interior, non-fire-rated hinged doors: 5 lbf applied perpendicular to door
   b. Sliding or folding doors: 5 lbf applied parallel to door at latch.
   c. Fire Doors: minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

1.4 SUBMITTALS

A. Product Data: For each item of hardware indicated furnish manufacturer's technical product data highlighting information pertaining specifically to product(s) submitted. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Hardware Schedule: Submit final hardware schedule, concurrent with Product Data, in manner indicated below. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.

1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" complying with scheduling sequence and vertical format in Door & Hardware Institute's "Sequence and Format for the Hardware Schedule" indicating complete designations of every item required for each door or opening. Include the following information.

   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Door and frame information including size, label, material, handing.
   e. Location of hardware set cross-referenced to indications on drawings both on floor plans and in door schedule, i.e., Corridor to Classroom.
   f. Keying information.
   g. Door Index – cross referencing door number with set and/or page number. If the sets are not in numerical order the door number, set number and page number are required. The hardware set number shown on a door submittal does not qualify as the door index for hardware.

2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other

work (e.g., hollow metal frames) which is critical in the project construction schedule.

3. Keying Schedule: Submit a separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks and/or cores has been fulfilled in accord with keying conference.

C. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of such other work, to confirm that adequate provisions are made for proper installation of hardware.

D. Closeout Submittals Package: Submit as a complete package.

1. Operation and Maintenance Manuals: Furnish two (2) hardcover three ring binders with the project name and number displayed on the front cover and spine. Include:

a. List of Manufacturers.
b. Approved Finish Hardware Schedule.
c. Approved Manufacturers' Product Data Sheets.
d. Manufacturer's operation, installation, maintenance, and repair instructions for each type of hardware furnished.
e. Templates for kind of hardware furnished.
f. Parts List for each type of finish hardware furnished.
g. Manufacturers dated written warranty for each type of finish hardware furnished.
h. Certifications: Written certification from Company Field Advisors that their products are installed according to manufacturers' printed installation instructions, are operating properly, and manufacturers' written warranty will be in effect upon physical completion of the Work.
i. Special Tools: List of special tools required to install hardware, and their purpose.

2. At conclusion of finish hardware installation, turn over to Director's Representative two (2) of each special tool required to install hardware together with a list of these tools and their purpose.

1.5 PRODUCT HANDLING

A. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package.

B. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

D. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.6 WARRANTY

A. All hardware shall carry a manufacturer's product warranty against defects in materials, workmanship and operation for a minimum period as follows:
   1. Continuous Hinges – limited lifetime
   2. Locksets – 10 years (cylindrical mechanical)
   3. Locksets – 3 years (mortise mechanical)
   4. Door Closers – 25 years (mechanical), 2 years (electric)
   5. Exit Devices – 3 years (mechanical)
   6. Electric Strikes – 5 years
   7. Balance of Miscellaneous Hardware – 1 year

PART 2 - PRODUCTS

2.1 SCHEDULE HARDWARE

A. Requirements for design, grade function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:

   1. Manufacturer's Product Designations: One manufacturer is listed for each hardware type required for purposes of establishing minimum requirements. Provide either the product designated, or the comparable product of another manufacturer listed which complies with requirements including those specified elsewhere in this section.

2.2 MATERIALS AND FABRICATION

A. General:

   1. Hand of Door: Drawings show direction of swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
   2. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated.
   3. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

      a. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish.
      b. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for

installation where bolt head or nut on opposite face is exposed in other work, except where noted or it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.

4. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instruction as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 LOCK CYLINDERS AND KEYING

A. Provide locksets and cylinders for interchangeable-core pin tumbler inserts. Furnish temporary keyed alike construction cores #7190224 (7 Pin) with three keys total and remove these when directed. Cores shall be painted a color for easy identification (blue, orange, etc.) The construction cores remain the property of the supplier and shall be returned to the supplier when they are removed.

B. Provide two construction control keys for removing temporary cores.

1. Final permanent keyed cores and keys shall be provided by the Owner.

C. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.

2.4 LOCKS, LATCHES AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

1. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
2. Provide roller type strikes where recommended by manufacturer of the latch and lock units.

B. Lock Throw: Comply with UL requirements for throw of bolts and latch bolts on rated fire opening, and as follows:
1. Bored Locks: Minimum 1/2-inch latchbolt throw
2. Mortise Locks: Minimum 3/4-inch latchbolt throw
3. Deadbolts: Minimum 1-inch bolt throw

C. All doors shall be readily operable from the egress side of the door without the use of a key or special knowledge or effort.

2.5 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for sizing of door control unit, depending upon size of door, fire door requirements, accessibility, and anticipated frequency of use.
1. Provide all drop plates, shoe supports, blade stop spacers, templates, etc. to properly mount closers according to manufacturer's recommendations.
2. All closers shall have metal covers.
3. All door closers shall meet UL10C standard positive pressure fire test of door assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendation. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards. Hand tighten screws and fasteners; use of power tools must be limited to preliminary driving screws if permitted by the door and hardware manufacturer.

E. Exterior door thresholds: Notch around frames and/or mullions and set thresholds in full bed of sealant complying with requirements specified in Section 079200 “Joint Sealants.”

F. Door closers shall be installed to obtain the greatest degree swing allowed by field conditions. Follow manufacturer’s instructions for proper door closer adjustment for spring power, back check, closing and latching speed.

G. Provide and install all low voltage control wiring from power supply to all door hardware. Provide and install 120V power wiring from EC-provided junction box to power supply (supplied under this spec section). Provide wiring as recommended by device manufacturer.

3.2 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. 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.

D. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.3 GENERAL NOTES

A. Supplier shall assume full responsibility for examination of the drawings and shall be responsible for the accuracy of the quantities, size, finish and proper hardware whether specifically mentioned or not. Hardware not listed specifically must be furnished to match other hardware in similar openings.

B. Provide all required accessories and options necessary for complete installation of each hardware component, to ensure proper operation of the product.

3.4 MANUFACTURERS

A. Acceptable Manufacturers: Provide required hardware manufactured by one of the following manufacturers. Those underlined were utilized to prepare the hardware schedule.

1.	Continuous Hinges	- ABH, Pemko, Select Products
2.	Door Closers	- Dorma, LCN, Sargent
3.	Locksets	- Best Access Systems to match existing
4.	Exit devices	- Precision, Von Duprin, Sargent
5.	Stops/Bumper	- Rockwood, Burns, Ives
6.	Kick Plates	- Rockwood, Burns, Ives
7.	Weather/Sound Seal	- Pemko, National Guard, Zero
8.	Smoke Seal	- Pemko, National Guard, Zero
9.	Thresholds	- Pemko, National Guard, Zero

3.5 HARDWARE CODES:

100	1 ea.	continuous hinge A110HD C
100A	1 ea.	continuous hinge A110HD C Prep EPT
101	1 ea.	continuous hinge A240HD C
101A	1 ea.	electric continuous hinge A240HD EA12 C
200	1 ea.	closer (pull side) 8916 AF89 FMC SN1 689
201	1 ea.	closer (push side) 8916 SPA FMC SN1 689
201A	1 ea.	closer (push side top jamb) 8916 AF89J FMC 689
202	1 ea.	closer (push side stop arm) 8916 DS FMC SN1 689
203	1 ea.	closer (push side stop hold open arm) 8916 DST FMC SN1 689
207	1 ea.	electronic track holder LCN 4040SEH-3038 w/arm Alum 24V or 120V (VIF) (Mount on pull side of door opposite from closer side)

Provide drop plates, spacers and shoe supports as required

300	1 ea.	rim exit device FL2114 x 4914A SNB US32D (Passage, no cylinder)
300LD	1 ea.	rim exit device FL2110VI x V4908A SNB US32D with visible indicator (Key outside retracts latch, key inside locks and unlocks outside lever)
301	1 ea.	rim exit device FL2103 x 4903A SNB US32D (Night latch, always locked)
302	1 ea.	surface vertical rod exit device FL2201 LBR SNB US32D (Exit only)

303	1 ea.	surface vertical rod exit device FL2214 x 4914A SNB US32D (Passage, no cylinder)
304	1 ea.	rim exit device MLR2103 x CA-03 SNB US32D with motorized electric latch retraction
304A	1 ea.	rim exit device MLR2103 x 4903A SNB US32D with motorized electric latch retraction
305	1 ea.	rim exit device CD2101 SNB US32D
305A	1 ea.	rim exit device CD2102 x 4902A SNB US32D
306	1 ea.	keyed removable mullion KR822 689
307	1 ea.	power transfer EPT-12C
308	1 ea.	power supply RPSMLR2BB with batteries
Note:	LBR =	less bottom rod - spring loaded auxiliary latch bolt must be installed in lower door edge at fire rated doors.

400	1 ea.	rim cylinder 12E72 x 7190224 or mortise 1E74 x 7190224 626, as required
400A	1 ea.	permanent keyed core provided by District
401	1 ea.	lockset (classroom) 9K3-7R15D x 7190224 626
401LD	1 ea.	lockset (classroom intruder) 9K3-7IN15D x 2/7190224 626
402	1 ea.	lockset (storeroom) 9K3-7D15D x 7190224 626
406	1 ea.	mortise lockset (restroom)Sargent V20-LB-70-8225OL US26D x Best 7190224 core with occupancy indicator "Vacant/Occupied" & ADA thumb turn (Indicator with "Locked/Unlocked" not acceptable) (Key outside allows door to remain either in locked or unlocked position)

503	3 ea.	silencers 608-RKW @ Single Doors, 2 @ Pair Doors
504	1 ea.	wall bumper 406 @ exit devices, 409 @ locksets US32D or floor stop 441 US26D
507	1 ea.	surface wall mounted magnetic door holder LCN SEM7830 689
507A	1 ea.	floor mounted magnetic door holder LCN SEM7820 689

600	1 ea.	kick plate 8" x 2" LDW for Single Doors, 8" x 1"LDW for Pair Doors US32D B4E .050 CSK (countersunk screw holes)
602	1 ea.	flush pull by Section 081540

700	1 ea.	smoke seal S771C (Clear) at meeting stile
701	1 set	smoke seal 316AS x TKSP for H&J
702	1 ea.	door sweep 315CN x TKSP
703	1 set	weatherstrip for H, J & Meeting Stile by Section 081540
704	1 ea.	mullion seal 5110BL

800	1 ea.	aluminum threshold 151A - 1/4"H x 3"W x MS10SS
801	1 ea.	aluminum threshold 253x3AFG - 1/2"H x 6-1/8"W x MSES25SS

1000	1 ea.	access control by others

3.6 HARDWARE SETS (DOOR/CODE NUMBERS):

SET 1	
B1.0D (2)	100-100A-2/203-304-305-306-307-308-3/400-3/400A-2/602-2/702-703-704-801-1000
B1.3A (2)	100-100A-2/203-304-305-306-307-308-3/400-3/400A-2/702-2/602-703-704-801-1000
	(Door B1.3A shares power supply with B1.2A)
SET 2	
B1.2A (2)	101-101A-2/203-304A-305A-306-3/400-3/400A-2/600-1000
	(Share power supply with B1.3A)
SET 3	
101A	101-202-300LD-2/400-2/400A-600-701
102A	101-202-300LD-2/400-2/400A-600-701
103A	101-202-300LD-2/400-2/400A-600-701
SET 4	
B1.1C (2)	2/101-2/202-2/207-2/302-2/600-700-701
SET 5	
B1.2B (2)	2/101-2/201A-2/303-507-507A-2/600-700-701
SET 6	
B1.0C	101-202-301-400-400A-600-701-800
SET 7	
B1.0B	101-200-2/400A-401LD-504-600-701-800
SET 8	
104A	101-200-400A-406-504-600-701
105A	101-200-400A-406-504-600-701
SET 9	
107A	101-400A-406-503-504-600
SET 10	
106A	101-200-400A-401-504-600-701
SET 11	
B1.0A	101-202-400A-402-600-701-800
SET 12	
B1.1A	101-202-400A-402-600-701

B1.1B	101-202-400A-402-600-701

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 085113 “Aluminum Windows” for factory glazing of aluminum windows.

1.2 SUMMARY

A. Section includes glass for:

1. Windows.
2. Doors.
3. Glazed entrances.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch lengths.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of glass and glazing product, from manufacturer.

B. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer’s test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to furnish, FOB point of manufacture/freight allowed to project site, replacement units for coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: Manufacturer's standard but not less than 10 years from date of manufacture.

B. Manufacturer's Special Warranty on Laminated Glass: Provide manufacturer’s written warranty agreeing to furnish, FOB point of manufacture/freight allowed to project site, replacement units for laminated glass units which deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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

1. Warranty Period: Manufacturer's standard but not less than 5 years from date of manufacture.

C. Manufacturer’s Special Warranty on Insulating Glass: Provide manufacturer's written warranty agreeing to furnish, FOB point of manufacture/freight allowed to project site, replacement units for insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seals (excluding that due to glass breakage); hermetic seal failure is defined to include intrusion of moisture or dirt, internal condensation at temperatures above -20°F, and other visual evidence of seal failure or performance failure, provided manufacturer's instructions for handling, installation, protection and maintenance have been adhered to during warranty period.

1. Warranty Period: Manufacturer's standard but not less than 10 years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. Clear Float Glass, Heat Treated Glass and Laminated Glass: Vitro Architectural Glass, Guardian Industries Corp., and Viracon, Inc.
2. Insulating Glass: Vitro Architectural Glass, Guardian Industries Corp., and Viracon, Inc.
3. Clear Fire Rated Glazing: Technical Glass Products, SAFTI *FIRST*, and Vetrotech Saint-Gobain.
4. Forced entry resistant laminated and insulating Glass: School Guard Glass
5. Insulated Panels: Mapes Industries, Inc.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.

2. Design Snow Loads: As indicated on Drawings.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide insulating-glass units with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

E. Interior Glazing: All interior glazing sizes and types shall comply with NFPA 80 and/or ASTM E119.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, as applicable to glass types, unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

F. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) unless otherwise indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS UNITS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Polypropylene-covered stainless steel in color selected by Architect.

    a. Basis of Design: Technoform Glass Insulation; TGI-Spacer.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F temperature-rise limitation; and the fire-resistance rating in minutes.

C. Fire-Protection-Rated Tempered Glass (FPSG -1): 1/4-inch (6-mm) thickness, fire-protection-rated tempered glass; and complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

D. Double Glazing Units with Clear Gel Fill (FPSG-2): Double glazing units made from two lites of uncoated, fully tempered, ultraclear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent gel; and complying with 16 CFR 1201, Category II.

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. Basis of Design: SAFTI *FIRST*; SuperLite II-XL.

2. Nominal Thickness: 3/4-inch (45 min).

2.8 FIRE-RESISTANCE-RATED GLAZING

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E 119 or UL 263.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.

C. Double Glazing Units with Clear Gel Fill: Double glazing units made from two lites of uncoated, fully tempered, ultraclear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent gel; and complying with 16 CFR 1201, Category II.

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. Basis of Design: SAFTI *FIRST*; SuperLite II-XL.

2. Nominal Thickness: 3/4-inch.

2.9 GLAZING SEALANTS AND COMPONENTS

A. General:

1. Compatibility: Provide 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. Glazing Sealants for Fire-Rated Glazing Products: Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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. The Dow Chemical Company; DOWSIL 795.
b. GE Construction Sealants; SilGlaze II SCS2800.
c. Pecora Corporation; Pecora 864NST.
d. Tremco Incorporated; Spectrem 2.

2. Applications: Interior and Exterior Glazing.

C. Glazing Tapes:

1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

a. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
b. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written

instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

    a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.12 INSULATED LAMINATED METAL-FACED PANELS

A. Mapes-R+ Rabbet Edge Panels as manufactured by Mapes Industries, Inc.

B. Finish

1. Exterior: Class 1 Dark Bronze Anodized, .040-inched thick
2. Interior: Standard Kynar
3. Color as selected by Architect.

C. Panel Fabrication

1. Exterior Substrate: Solid Plastic (SPS)
2. Exterior Core: Isocyanurate
3. Smooth Mill Aluminum
4. Secondary Exterior Substrate: Solid Plastic (SPS)
5. Interior Core: Isocyanurate
6. Interior Substrate: Solid Plastic (SPS)
7. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness
8. Overall Panel Thickness – 3-inches
9. Glazing Leg Thickness – 1-inches
10. R-Value - 28.76

D. Recommended for use as an infill panel component in window and curtain wall systems. Related material to complete installation as recommended by the manufacturer.

E. Seals against moisture intrusion as recommended by the manufacturer. Polyurethane and silicone based sealant with a 20 year life are recommended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. Fire-Rated Glazing: Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. 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.
2. 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.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape 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.

H. Apply cap bead of elastomeric sealant over exposed edge of tape at locations where fixed stop is located on the exterior.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch 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. Installation with Drive-in Wedge Gaskets: 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. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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 buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type **IRSG**: Clear fully tempered float glass.

1. Minimum Thickness: 1/4-inch (6-mm).
2. Safety glazing required.

3.9 LAMINATED GLASS SCHEDULE

A. Glass Type **LG**: Clear laminated forced-entry resistant glass with two plies of fully tempered float glass by School Guard Glass # SGG-L6-SG4T.

1. Thickness 3/8-inch (9 mm).
2. Interlayer SG4 film.
3. Safety glazing required.

3.10 INSULATING GLASS SCHEDULE

A. Glass Type **INSG-1**: Low-E-coated, clear insulating glass.

1. Basis of Design Product: Solarban® 60 solar control glass as manufactured by Vitro Architectural Glass.
2. Overall Unit Thickness: 1-inch (25-mm).
3. Minimum Thickness of Each Glass Lite: 1/4-inch (6 mm).
4. Outdoor Lite: Fully tempered float glass.

5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.

8. Winter Nighttime U-Factor: 0.24 maximum.
9. Visible Light Transmittance: 70 percent minimum.
10. Solar Heat Gain Coefficient: 0.39 maximum.

11. Safety glazing required.

B. Glass Type **INSG-2**: Low-E-coated, **translucent acid-etched** insulating glass.

1. Basis of Design Product: Solarban® 60 solar control glass as manufactured by Vitro Architectural Glass.
2. Overall Unit Thickness: 1-inch (25-mm).
3. Minimum Thickness of Each Glass Lite: 1/4-inch (6 mm).
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered **acid etched** float glass.
7. Low-E Coating: Sputtered on second surface.

8. Winter Nighttime U-Factor: 0.24 maximum.
9. Visible Light Transmittance: 70 percent minimum.
10. Solar Heat Gain Coefficient: 0.39 maximum.

11. Safety glazing required.

3.11 INSULATING-LAMINATED-GLASS SCHEDULE

A. Glass Type **INLG**: Low-E-coated, clear insulating laminated forced-entry resistant glass.

1. Basis of Design: School Guard Glass™ Security Glazing 1" Laminated Insulated Glass Unit (PRODUCT #: SGG-IG16.SG4.SB60-T4.SP6-ARG).
2. Overall Unit Thickness: 1-inch.
3. Outdoor Lite: 1/4" Tempered Clear Glass w/ Solarban 60 Low-e (#2).
4. Interspace: 3/8" Argon Gas Filled Space .
5. Indoor Lite: 3/8" Proprietary School Guard SG4.

3.12 INSULATING PANELS

A. Glass Type **IP:** Insulated Laminated Metal-faced Panel

3.13 FIRE-PROTECTION-RATED GLAZING SCHEDULE

A. Glass Type **FPSG-1**: 20-minute fire-protection-rated tempered safety glazing without hose-stream test; fire-protection-rated tempered glass.

B. Glass Type **FPSG-2**: fire-protection-rated safety glazing; double glazing units with clear gel fill.

1. Rating: As indicated on Drawings.

3.14 FIRE-RESISTANCE-RATED GLAZING SCHEDULE

A. Glass Type **FRSG**: Fire-resistance-rated safety glazing with 450 deg F temperature-rise limitation; double glazing units with clear gel fill**.**

1. Rating: As indicated on Drawings.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:
   1. Section 072100 "Building Insulation."

1.2 SUMMARY

A. Section Includes:

   1. Non-load-bearing steel framing for gypsum board assemblies.
   2. Grid suspension systems for gypsum board ceilings.
   3. Interior gypsum board.
   4. Tile Backing Panels.
   5. Plaster wall liner. "PWL"

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

C. Samples for Initial Selection:

   1. For each type of trim accessory indicated.
   2. For each type of corner guard. Include accent strips and accessories to verify color selection.

D. Samples for Verification: For the following products:

   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Corner Guards: 12 inches long. Include example top caps.

1.4 INFORMATION SUBMITTALS

A. Evaluation Reports: For steel studs and tracks, firestop tracks, and post-installed anchors from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code-compliance program.

B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

D. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Framing."

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Horizontal Deflection:

1. For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.
2. For wall assemblies to be finished with plaster, tile, stone, or other brittle finish material, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft.

B. Design framing systems in accordance with AISI S220 and ASTM C645, Section 10, unless otherwise indicated.

2.2 STEEL FRAMING

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. ClarkDietrich Building Systems.
2. CEMCO; California Expanded Metal Products Co.
3. SCAFCO Steel Stud Company.
4. The Steel Network, Inc.
5. Architect's approved equal.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal unless otherwise indicated

2. Protective Coating: ASTM C645; ASTM A 653/A 653M, G40, hot-dip galvanized or coating with equivalent corrosion resistance of G40 (Z120) unless otherwise indicated. A40 galvannealed products are not acceptable.

a. Coating shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

C. Studs and Tracks: AISI S220 and ASTM C645, Section 10. Use either steel studs and tracks or embossed steel studs and tracks unless noted otherwise.

1. Product: ClarkDietrich; ProSTUD 30 and ProTRAK 30 with Smart Edge technology or comparable product.
2. Minimum Base-Steel Thickness unless indicated on Drawings: 0.0296 inch; increase base-steel thickness as required to meet performance requirements for horizontal deflection.
3. Depth: As indicated on drawings.
4. Provide certification that steel studs can be used with impact resistant assemblies.

D. Slip-Type Head Joints: Where indicated, provide the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
2) ClarkDietrich Building Systems; Fast Top Clip.
3) Architect's approved equal.

2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1) ClarkDietrich Building Systems; MaxTrak (SLT).
2) CEMCO; "CST" Slotted Track.
3) Architect's approved equal.

E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of the 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.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. ClarkDietrich; [BlazeFrame DSL] [BlazeFrame RipTRAK] [MaxTrak]
b. Fire Trak Corp.; Fire Trak.
c. Architect's approved equal.

F. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

1. Product: ClarkDietrich; RC Deluxe (RCSD) Resilient Channel, or comparable product.
2. Configuration: Asymmetrical or hat shaped.

G. Z-Furring Members: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum base-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

1. Product: ClarkDietrich; Z-Furring Channel or comparable product.

H. Backing Plate: Proprietary fire-resistance-treated blocking and bracing in width indicated.

1. Basis-of-Design Product: ClarkDietrich Building Systems; Danback Fire-treated Wood Backing Plate D16F and D24F.

I. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Basis-of-Design Product: ClarkDietrich Building Systems; Backing Plate.
2. Minimum Base-Steel Thickness: 0.0296 inch.

2.3 GRID SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.; Armstrong Drywall Grid System.
2. CertainTeed; Drywall Suspension System.
3. USG Corporation; USG Drywall Suspension System.

B. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung, hot-dipped galvanized, heavy duty system per ASTM C 635, composed of main beams and cross-furring members that interlock.

C. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, AC193, AC58 or AC308 as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

c. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

D. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

2.4 GYPSUM BOARD MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Georgia-Pacific Building Products.
3. National Gypsum Company.
4. USG Corporation.

2.5 INTERIOR GYPSUM BOARD

A. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Basis of Design: National Gypsum Company; Gold Bond Brand High Strength Ceiling Board.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

B. Impact-Resistant, Moisture and Mold Resistant, Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.

1. Basis of Design: National Gypsum Company; Gold Bond Brand HI-IMPACT XP Gypsum Board.

2. Core: 5/8 inch, Type X.

3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
6. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 EXTERIOR GYPSUM SHEATHING BOARD

A. Glass-Mat, Moisture and Mold Resistant, Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Basis of Design: National Gypsum Company; Gold Bond Brand eXPSheathing.
2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.7 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Basis of Design: National Gypsum Company; Gold Bond Brand eXP Tile Backer.
2. Core: 5/8 inch, Type X].
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.8 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet.
2. Shapes:

a. Cornerbead; use on outside corners unless otherwise indicated.
   1) Product: ClarkDietrich; 103 Deluxe Cornerbead, or comparable product.

b. LC-Bead: J-shaped; exposed long flange receives joint compound; use for edge trim unless otherwise indicated.
   1) Product: ClarkDietrich; Metal U-Trim M20A, or comparable product.

c. L-Bead: L-shaped; exposed long flange receives joint compound.
   1) Product: ClarkDietrich; Metal L-Trim M20B, or comparable product.

d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   1) Product: ClarkDietrich; Metal J-Trim M400 Series, or comparable product.

e. Expansion (control) joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
   1) Product: ClarkDietrich; #093 Control Joint, or comparable product.

f. Curved-Edge Cornerbead: With notched or flexible flanges.

2.9 PLASTER WALL LINER FABRIC - PWL

A. Faster Plaster Wall Covering: Manufactured by FLEXI-Wall Systems is a paintable wall covering. Basis Of Design

1. Product: Faster Plaster Medium Duty 605 (33 Mil.)

a. Refer to section 2.9 for joint treatment.

2. Fire Classification: Class A per ASTM E84.

B. Adhesive: Adhesive #500 is a water based Adhesive manufactured by Flexi Walls

2.10 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of panel products and of joint treatment materials for each application indicated.

B. Joint Tape:

1. Interior Gypsum Board: Paper, unless otherwise indicated.

a. Product: ClarkDietrich; Strait-Flex Butt-Tape, or comparable product.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

a. Product: ClarkDietrich; Strait-Flex Tile-Tape, or comparable product.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.11 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

D. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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. Grabber Construction Products; Acoustical Sealant GSCSF.
b. Pecora Corporation; AIS-919 Acoustical Sealant.
c. USG Corporation; SHEETROCK Acoustical Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness

of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 STEEL FRAMING INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with USG Corporation's "Gypsum Construction Handbook."

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with steel framing members. Frame both sides of joints independently.

F. Provide control joints as shown on Drawings, or if not shown, at 30 feet on center.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

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. Install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
2. 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.
3. 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.

4. 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.
5. 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.

6. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

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 inches 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.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. General: Install grid members in accordance with ASTM C 636, CISCA installation standards, other applicable references, and as required to comply with seismic requirements.

1. Manufacturer's Reference: Install in accordance with manufacturer's current printed recommendations.
2. Drawing Reference: Install in accordance with approved shop drawings and locate ceiling in accordance with main tee dimensions relative to elevations.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.7 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings.
3. Ceiling Type: As indicated on Drawings.
4. Impact-Resistant Type: As indicated on Drawings.
5. Type C: As indicated on Drawings and where required for specific fire-resistance-rated assembly indicated.
6. Glass-Mat Interior Type: As indicated on Drawings.
7. Acoustically Enhanced Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.8 APPLYING EXTERIOR GYPSUM PANELS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations, unless otherwise indicated.
2. Fasten with corrosion-resistant screws.

3.9 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.10 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joins: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect, or at locations indicated.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use at exposed panel edges where trim can only be installed after gypsum panels are installed.
4. U-Bead: Use where indicated.

5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.11 INSTALLING PLASTER WALL LINER

A. Install in locations indicated on drawings in accordance with Manufacturer's recommendations.

B. Remove burrs of excess cement or other protrusions and then apply wall liner as conventional wall covering. Curing time is 24 hours, after which application of paint, decorative wallcovering or skim coating may be applied.

3.12 FINISHING GYPSUM BOARD AND PLASTER WALL LINER

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. For aluminum trim, apply joint tape to flanges of trim as recommended by trim manufacturer.

E. Gypsum Board and Plaster Wall Liner Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: At joints and interior angles, embed the tape in the joint compound. Panel surfaces must be free of excess joint compound, but tool marks and ridges are acceptable.

    a. Applications: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 4: At joints and interior angles, embed the tape in the joint compound and immediately apply the joint compound over the tape. Apply two additional separate coats of the joint compound over flat joints. Apply one additional coat of the joint compound over interior angles. Apply three separate coats of the joint compound over fastener heads and flanges of trim accessories. Panel surfaces and the joint compound must be smooth and free of tool marks and ridges. Cover the prepared surface with a drywall primer prior to the application of the final decoration.

    a. Applications: At panel surfaces that will be exposed to view unless otherwise indicated.
    b. Primer and its application to surfaces are specified in Section 099100 "Painting."

3. Level 5: At joints and interior angles, embed the tape in the joint compound and immediately apply the joint compound over the tape. Apply two additional separate coats of the joint compound over flat joints. Apply one additional coat of the joint compound over interior angles. Apply three separate coats of the joint compound over fastener heads and flanges of trim accessories. Apply a skim coat over the entire gypsum board surface. Panel surfaces and the joint compound must be smooth and

free of tool marks and ridges. Cover the prepared surface with a drywall primer prior to the application of the final decoration.

a. Applications: Gypsum wall board corridor walls .
b. Primer and its application to surfaces are specified in Section 099100 "Painting."

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.13 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093000 – TILE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board Assemblies" for tile backing panels.

1.2 SUMMARY

A. Section Includes:
1. Glazed wall tile.
2. Stone thresholds.
3. Metal edge strips and movement joints.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, ANSI A108.17, and ANSI A108.19, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each type, and composition of tile, signed by tile manufacturer and Installer; submit following shipment of tile.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Firm specializing in tile installation with not less than five years of experience in installation of tile similar to that required for this project.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location at a temperature greater than 50 deg F.

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

D. Protect liquid materials from freezing and store in unopened containers at a temperature greater than 50 deg F.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not install tile until construction in spaces is complete.
2. Maintain temperatures at not less than 50 deg F in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced ANSI standards or manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to the following:

1. Ceramic Tile Manufacturers:

a. Daltile Corporation.
b. American Olean Tile Co.
c. Crossville Inc.
d. Olympia Tile Inc.

2. Setting and Grouting Material Manufacturers:

a. Custom Building Products.
b. Flextile Ltd.
c. Laticrete International Inc.
d. MAPEI Corporation.
e. TEC; a subsidiary of H. B. Fuller Construction Products Inc.

B. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
2. Tiles of different shades may be used if isolated in separate rooms that do not make shading apparent. Prior to installation, architect must be made aware of tiles that are medium-to-heavy shaded to review proper layout.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof/crack isolation membranes, except for sheet products, from manufacturer of setting and grouting materials.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Tile backing panels.
5. Metal edge strips and movement joints.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
2. Glass mosaic tile may be back mounted onto net or paper, or face mounted with paper or clear tape.

2.3 TILE PRODUCTS

A. Ceramic Tile Type **CT**: Glazed wall tile.

1. Basis of Design: Daltile; COLOR WHEEL™ COLLECTION – GLAZED CERAMIC "LINEAR"
2. Module Size: 4 by 16 inches.
3. Thickness: 3/8 inch.
4. Face: Plain with cushion edges.
5. Finish: Semi-gloss.
6. Tile Color and Pattern: Two color pattern selected by architect from manufacturer's full range of Semi-Gloss and Accent colors in price groups 1, 2, and 3.
7. Grout Color: As selected by Architect from manufacturer's full range.

8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile unless otherwise indicated. Provide cove base, bullnose cap, and finished external corners. All cut tiles are to be hidden at in-corners.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Unless otherwise indicated, bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.5 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Basis of Design Product: Custom Building Products; "VersaBond Professional Thin-Set Mortar" or "VersaBond-LFT Professional Large Format Tile Mortar" for tile designated "Large Format Tile."
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Basis of Design Product: Custom Building Products; "CEG-Lite 100% Solids Commercial Epoxy Grout."

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass exposed-edge material, by Schluter Systems L.P. or approved equal.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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 bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
5. Alteration Work:

    a. Inspect existing surfaces for proper elevations, bonding properties, etc. Prepare existing surfaces as necessary to provide a guaranteed bond of new work.
    b. Verify in field, the location, extent, and type of ceramic tile work required for alteration work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. 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.

3.3 CERAMIC TILE INSTALLATION

A. Comply with latest edition of TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.

B. 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.

C. 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.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. 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.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Glazed Wall Tile: 1/16 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Construct joints per TCNA EJ171. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles. If not indicated, provide expansion joints over all joints in substrate, at perimeter movement joints (e.g., walls, columns, etc.), and at 12 feet maximum spacing in each direction.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Provide expansion joints minimum 1/4- inch wide, unless otherwise noted, with backer rod and sealant. Sealant color to match adjacent grout color.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
2. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in thinset mortar. Fill joints between such thresholds and adjoining tile with elastomeric sealant.

3.4 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Masonry or Concrete:

1. Ceramic Tile Installation: TCNA W202; thinset mortar.

a. Ceramic Tile Type: **CT**.
b. Thinset Mortar: Modified dry-set mortar.
c. Grout: Water-Cleanable Epoxy Grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W245; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Ceramic Tile Type: **CT**.
b. Thinset Mortar: Modified dry-set mortar.
a. Grout: Water-Cleanable Epoxy Grout.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 095423 "Linear Wood Ceilings" for ceilings consisting of wood units with exposed and concealed suspension systems.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension system for interior ceilings.

1.3 DEFINITIONS

A. CAC: Ceiling Attenuation Class.

B. LR: Light-Reflectance coefficient.

C. NRC: Noise Reduction Coefficient.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panels: Set of 6-inch square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch long Samples of each type, finish, and color.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials to the Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

Note: This extra material is NOT to be used by contractors for repair work.

1.9 QUALITY ASSURANCE

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected

against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. 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: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS, TYPE APC

A. Basis of Design Products: "Ultima," No. 1910 and No. 1913, as manufactured by Armstrong World Industries, or "Mars ClimaPlus," No. 86185 and No. 88185, as manufactured by USG Corporation.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
2. Pattern: E (lightly textured).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.90.

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.75.

H. Edge/Joint Detail: Square.

I. Thickness: 3/4 inch.

J. Modular Size: 24 by 24 inches or 24 by 48 inches as indicated on Drawings.

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Basis of Design Products: “Prelude XL,” as manufactured by Armstrong World Industries, or “Donn Brand DX/DXL,” as manufactured by USG Corporation.

a. Structural Classification: Heavy-duty system.
b. Face Design: Flat, flush.
c. Cap Material: Cold-rolled steel or aluminum.
d. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion or postinstalled bonded anchors.
b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.
c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316.

d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

1) Provide at Natatorium/Swimming Pool ceilings and at other areas indicated on the Drawings.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.

a. Provide at Natatorium/Swimming Pool ceilings and at other areas indicated on the Drawings.

4. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down clips.

D. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

E. Seismic Clips: Manufacturer's standard seismic clips designed to secure metal suspension system runners to perimeter angle for seismic design categories C-F.

1. Basis of Design Products: “BERC2,” as manufactured by Armstrong World Industries, or “ACM7 Seismic Clip,” as manufactured by USG Corporation.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile specified herein or indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Angle Molding: Manufacturer's standard 7/8 inch wide by 12 foot long hemmed edge angle molding and accessories for edges and penetrations of ceiling.

a. Provide manufacturer’s standard radius molding corner clips at locations where angle molding abuts radiused/bullnosed corners.

2. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.

3. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
4. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Basis of Design Products: "AXIOM Classic Trim," as manufactured by Armstrong World Industries, or "Compässo Elite," as manufactured by USG Corporation.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 METAL FURRING AND FASTENERS

A. Furring: Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch unless otherwise indicated.
2. Depth: As indicated on Drawings.

B. Fasteners: Toggle or molly bolts, length as required to anchor furring to existing suspended plaster ceiling.

2.8 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

1. Basis of Design Product: Tremco, Inc., Tremflex 834.
2. Color: White.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

1. Basis of Design Product: Tremco, Inc., Tremco Acoustical/Curtainwall Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling unless otherwise indicated. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

B. Layout openings for penetrations centered on the penetrating items.

C. Coordinate layout and installation of acoustical ceiling panels and suspension system components with other work supported by or penetrating through ceilings, including electrical systems, mechanical systems and partitions.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Aluminum Suspension Systems in Seismic Design Categories D, E, or F: Space hangers not more than 30 inches o.c. along each member supported directly

from hangers unless otherwise indicated; provide hangers not more than 8-inches from ends of each member.

11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged surfaces and edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down, impact, and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

1) Install at:

a) Entryways/vestibules.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 095423 - LINEAR WOOD VENEER CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes strip, linear metal pans and suspension systems for ceilings.

1.3 COORDINATION

A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For components with factory-applied color and other decorative finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:

1. Linear Wood Veneer Slats: Set of 12-inch- long Samples of each type and color and a 12-inch- long spliced section.
2. Suspension System Members: 12-inch- long Sample of each type.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Linear pattern.
2. Joint pattern.
3. Ceiling suspension members.
4. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

6. Ceiling perimeter and penetrations through ceiling; trim and moldings.
7. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each linear metal ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For panels and components and anchor and fastener type.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 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. Wood Veneer Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to 2 percent of quantity installed.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than 5 years of experience in installation of commercial ceilings of type, quantity and installation methods similar to work of this section.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle panels, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

B. 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: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Armstrong World Industries:
   a. Basis of Design: Armstrong "WOODWORKS Linear Veneered Panels."

B. Source Limitations: Obtain each type of linear wood ceiling and its supporting suspension system from single source from single manufacturer.

2.3 LINEAR WOOD CEILING SYSTEMS, GENERAL

A. Wood Veneer Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, and finished to comply with requirements indicated.

B. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same wood and finish as slats.

C. Hook-on panels with downward accessibility; hooks are field-attached to factory pre-drilled holes by installer

2.4 WOOD VENEER PANELS

A. WoodWorks® Linear Veneered Panels:

1. Nominal 4" wide planks 3/4" Reveal
2. Item No. 6690F01W1
3. Dimensions Nominal W x L x H: 24 x 96 x 3/4"
4. Provide Black Matte BioAcoustic™ Infill Panel (Item No. 5823)
5. Finish: Stained in color selected from manufacturer's full range.

2.5 METAL SUSPENSION SYSTEMS

A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635/C 635M requirements.

B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion or postinstalled bonded anchors.
b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.

D. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

E. Carriers: Factory finished with matte-black baked finish.

1. Main Carriers: Aluminum, not less than 0.240-inch rolled sheet, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209.
2. Flexible Radial Carriers: Manufacturer's standard radial carriers.
3. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.

F. Carrier Splices: Same metal, profile, and finish as for carriers.

G. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.

2.6 ACCESSORIES

A. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Color-Coated Finish: Manufacturer's standard stain finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, and application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of linear metal ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width lengths at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Comply with ASTM C 636/C 636M and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of linear wood ceiling area and where necessary to conceal edges and ends of linear wood veneers.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Provide manufacturer's standard carriers for radii indicated.

E. Cut panels for accurate fit at borders and at interruptions and penetrations by other work through ceilings.

F. Install panels in coordination with suspension system and exposed moldings and trim.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
3. Install lengths with butt joints using internal splices and in the following joint configuration:
   a. Random.

3.4 CLEANING

A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Thermoset-rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

C. Samples for Initial Selection: For each type of product indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE (RB)

A. 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:
   1. Johnsonite; a Tarkett company.
   2. Roppe Corporation; Roppe Holding Company.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

   1. Style and Location:
      a. Style B, Cove: Provide in areas with resilient floor coverings.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As selected by Architect from Manufacturer's full range .

2.2 RUBBER MOLDING ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated into the work include, but are not limited to the following:

   1. Johnsonite; a Tarkett company
   2. Roppe Corporation; Roppe Holding Company.
   3. VPI Corporation.

C. Description: Provide Rubber transition strips, reducing strips, nosing for carpet, nosing for resilient floor covering as required to meet adjoining materials.

D. Profile and Dimensions: As required to make smooth transitions between adjoining materials and as indicated on Drawings by manufacturer's designations.

E. Locations: Provide rubber molding accessories as required to make smooth transitions between adjoining materials and in locations indicated on Drawings.

F. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches (76 mm) in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches (76 mm) in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal 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.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.

B. Related Sections:

1. Section 035416 - Hydraulic Cement Underlayment

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field Testing Reports: For concrete testing specified in Part 3

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers include, but are not limited to, the following:
1. Shaw Industries Group, Inc.

2.3 LUXURY VINYL FLOOR TILE (LVT)

A. Basis-of-Design Product: Subject to compliance with requirements provide Commercial Woven Luxury Vinyl Tile as manufactured by Shaw Industries Group, Inc.

1. Collection: Unite
2. Style to be selected by Architect from "Cove" and/or "Inlet" lines.

B. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.
2. Type: B, Embossed Surface.

C. Thickness: 0.197-inches.

D. Size: 9-inches by 48-inches.

E. Colors: As selected by Architect from "Cove" and/or "Inlet" lines. Include up to three colors colors.

F. Pattern: "Stagger" .

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated and including, but not limited to, the following special conditions.

1. High moisture content concrete slabs.
2. Existing resilient flooring (Tile-on installation).
3. Areas where heavy rolling loads are anticipated.

2.5 ACCESSORIES

A. See specification Section 096513.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. 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 floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. High-performance resinous flooring systems.
2. Self-leveling underlayment as part of resinous flooring system

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.

C. Material Certificates: For each resinous flooring component, from manufacturer.

D. Maintenance Data: For maintenance manuals.

E. Samples for initial selection: Submit Manufacturer's standard color card or sample kit.

F. Verification Samples: Submit three 12" X 12" samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Include up to three iterations of verification samples for review with owner to determine level of non-slip frit in finish.

1.3 QUALITY ASSURANCE

A. 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.

B. 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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by:

1. The Sherwin Williams Company, Cleveland, OH. swflooring@sherwin.com

B. Basis of design product: FasTop Deco Flake SL45, 3/16 inch – 1/4 inch nominal thickness (excluding self-leveling topping).

1. Cove Base: FasTop Multi Cove Base, 15-20 linear feet per kit at 6" with 1" radius.
2. Primer: Resuflor Aqua 3477 at 250 sq. ft. per gallon.
3. Slurry (1/4"): FasTop Multi SL45 32-34 sq. ft. per kit.
4. Broadcast: Decorative Flake at 100 lbs. per 1,000 sq. ft.
5. Grout Coat: Resuflor 3746 at 160-200 sq. ft. per gallon.
6. Seal Coat: Resuflor 4686 at 250-400 sq. ft. per gallon.
7. 46 grit white aluminum oxide to be included in the topcoat.

2.2 MATERIALS

A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

1. Resinous Flooring: 100 g/L.

B. Topping: Poly-Crete SLB as manufactured by Sherwin Williams, Inc

1. Hardness (Shore D), ASTM D-2240: 65 D
2. Compressive Strength, ASTM C-579: 9,000 psi
3. Tensile Strength, ASTM D-638: 4,200 psi
4. Impact Resistance, ASTM D-3134: Pass
5. Flexural Strength, ASTM D-790: 5,076 psi
6. Abrasion Resistance, CS-17 Wheel 1000 GM Load, 1,000 Cycles, ASTM D-4060: 30 mg loss
7. VOC Content: 0 g/L
8. Indoor Air Quality CA 01350: Compliant
9. Water Absorption, ASTM D-570: 0.04%

2.3 FINISHES:

A. Decorative Broadcast Material:

1. As selected by Architect from Torginal FLAKE Hybrid Stone and Terrazzo Collection.

2.4 HIGH-PERFORMANCE RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.

1. Abrasion Resistance ASTM D4060: 51 mgs lost
2. Hardness, Shore D ASTM D 2240: 83
3. Tensile Strength ASTM C 307: 944 psi
4. Compressive Strength ASTM C 579: 6,926 psi
5. Flexural Strength ASTM C 580: 1,909 psi
6. Adhesion ASTM 7234: 523 psi concrete failure
7. Impact Resistance IR4
8. Reaction to Fire: Bfl - s1
9. Thermal Expansion Coefcient: <38 PPM
10. Surface Frictional Properties ASTM E 303: -0.7 DCOF
11. Service Temperature at 3/16": -50°F - 266°F
12. Shrinkage: Nil
13. Water Absorption: Karsten Test (impermeable) - Nil

B. System Characteristics:

1. Color and Pattern: As indicated from manufacturers listed above.
2. Slip Resistance: Provide slip resistant finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.

B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:
1. Self-leveling mortars, to 3/16 inch:CSP-4 to CSP-6

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests indicated below.

    a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq ft.
    b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.2 ENVIRONMENTAL CONDITIONS

A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly instructions shall be implicitly followed.

B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 APPLICATIONS

A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.

    1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
    2. Install topcoat over flooring after excess aggregate has been removed.
    3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.

B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

    1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
    2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
    3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.

D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

E. Slip Resistant Finish: Provide grit for slip resistance.

F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

G. Application of Topping

1. Install over existing tile to infill grout joints and as self-leveling system as indicated on Drawings.
2. The topping shall be applied as a self-leveling system. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
3. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
4. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend. The topping shall be applied over horizontal surfaces using 1/2 inch "v" notched squeegee, trowels or other systems approved by the Manufacturer. Immediately upon placing, the topping shall be degassed with a loop roller.
5. Chip aggregate shall be broadcast to excess into the wet resin, Macro chip at the rate of 0.1 lbs/sf
6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.

3.4 COMPLETED WORK

A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.

B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

C. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION

SECTION 099100 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Extent of painting work is shown on Drawings and as herein specified.

B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project including, but not limited to, new work, patch work and existing work where required.

1. Finish patch work to match adjacent finishes.
2. Surface preparation, priming and coats of paint specified are in addition to shop-priming specified under other sections of work.

C. Work includes field painting of exposed bare and covered pipes and ducts and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, and other applied materials whether used as primed, intermediate or finish coats.

E. Paint exposed surfaces except where material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. Architect will select colors from standard colors available for materials systems specified.

F. Following categories of work are not included as part of field-applied finish work.

1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory finishing is specified for such items as (but not limited to) acoustic materials, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets.
2. Concealed Surfaces: Painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas.
3. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
4. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

a. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

G. Painting shall include accent striping as follows:

1. In all corridors, vestibules and lobby areas allow for a painted accent stripe and/or painted wainscoting as selected by the Architect.
2. In the gymnasium the underside of the bottom chord of the roof trusses shall be painted a separate accent color. The exposed ductwork may be painted a distinct color also, as selected by the Architect.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

B. Existing Exterior Paint Film Stripping and Removal Submittals:

1. Submit proposed materials and methods for removing existing paint films down to a clean and original undamaged substrate.

a. Depending upon the substrate to be stripped and thickness of paint films to be removed, acceptable methods of removal include hand or mechanical tools, pressure washing with water, heat or steam devices, chemical strippers and other appropriate methods.
b. Refer to SSPC standards
c. More aggressive paint stripping and removal methods will not be accepted when less aggressive methods are equally effective with less damage.
d. Chemical Strippers: As recommended by a letter of approval from finish paint manufacturer.

C. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets,

care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

A. Volatile Organic Compounds (VOCs) Regulatory Requirements: Chapter III of Title 6 of the official compilation of Codes, Rules and Regulations of the State of New York (Title 6 NYCRR), Part 205 Architectural and Industrial Maintenance (AIM) Coatings.

1. Certificate of Compliance: List of each paint product to be delivered and installed. List shall include written certification stating that each paint product listed complies with the VOC regulatory requirements in effect at the time of job site delivery and installation.

B. Container Labels: Label each product container with paint manufacturer's name, product name and number, color name and number, thinning and application instructions, date of manufacture and shelf-life expiration, required surface preparation, recommended coverage per gallon, wet and dry film thickness, drying time, and clean up procedures.

C. Field Examples:

1. Prior to on-site painting, at locations designated by the Architect's Representative, apply field examples of each paint type to be applied.
2. Field examples to be applied on actual substrates to be painted and shall duplicate earlier approved paint samples.

a. Interior field examples to be applied in rooms and spaces to be painted with the same products.
b. Field Example Minimum Wet and Dry Film Thickness: As indicated on approved product data sheet.
c. Application: Apply each coat in a smooth uniform wet mil thickness without brush marks, laps, holidays, runs, stains, cloudiness, discolorations, nail holes and other surface imperfections.

1) Leave a specified exposed width of each previous coat beneath each subsequent coat of finish paint and primer.

d. Use of Field Examples: Field examples shall serve as a quality control standard for acceptance or rejection of painting Work to be done under this Section.

3. Field Example Sizes:

a. Floor, Wall, and Ceiling Examples: 200 square feet with 2 foot wide strips.
b. Door and Frame Examples: One door and frame with 12 inch wide horizontal strips.

4. Do not begin applying paints represented by field examples until examples have been reviewed and approved by the Architect's Representative.

a. Protect and maintain approved field examples until all painting work represented by the example has been completed and approved.

5. Existing Exterior Paint Stripping and Removal Field Examples: Apply necessary number of examples required to determine least aggressive method for stripping and removing existing paint films without damaging the original substrate.

    a. Example Size: 5 feet by 5 feet at location designated by the Architect's Representative.

D. Compatibility of Paint Materials: Primers and intermediate paints shall be products manufactured or recommended by the finish paint manufacturer.

1.6 DELIVERY AND STORAGE

A. Delivery: Deliver materials to the Site in original, unopened containers and cartons bearing manufacturer's printed labels. Do not deliver products which have exceeded their shelf life, are in open or damaged containers or cartons, or are not properly labeled as specified.

B. Storage and Handling: Store products in a dry, well ventilated area in accordance with manufacturer's published product data sheets. Storage location shall have an ambient air temperature between 45 degrees F and 90 degrees F.

1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:

1. Ambient Air Temperature, Relative Humidity, Ventilation, and Surface Temperature: Comply with paint manufacturer's published product data sheet or other printed product instructions.
2. If paint manufacturer does not provide environmental requirements, use the following:

    a. Ambient Air Temperature: Between 45 degrees F and 75 degrees F.
    b. Relative Humidity: Below 75 percent.
    c. Ventilation: Maintain the painting environment free from fumes and odors throughout the Work of this Section.
    d. Surface Temperature: At least 5 degrees F above the surface dewpoint temperature.

3. Maintain environmental requirements throughout the drying period.

PART 2 - PRODUCTS

2.1 COLORS AND FINISHES

A. Architect will select colors for surfaces to be painted.

B. Wall colors shall include up to four colors throughout project, as selected by Architect.

2.2 PAINT PRODUCTS

A. Bedding Compound: Water based pre-mixed gypsum wallboard joint compound.

B. Cleaning Solvents: Low toxicity with flash point in excess of 100 degrees F.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Masking Tape: Removable paper or fiber tape, self-adhesive and nonstaining.

E. Metal Filler: Polyester resin base autobody filler.

F. Mineral Spirits: Low odor type recommended by finish paint manufacturer.

G. Nonskid Additive: Skid-Tex ST30 by Zinsser.

H. Paint Stripper: As recommended by finish paint manufacturer.

I. Spackling Compound: Water based pre-mixed plaster and gypsum wallboard finishing compound.

J. Stain Blocker, Primer-Sealer: As recommended by finish paint manufacturer.

K. Wood Putty: Water based pre-mixed wood filler. Color match putty to wood substrate beneath clear and semi-transparent finishes.

L. Wood Substrate Cleaner, Brightener, Conditioner, and Open-grain Sealer: As recommended by finish paint manufacturer.

2.3 MATERIAL QUALITY

A. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers including, but not limited to; The Sherwin-Williams Company (S-W), Benjamin Moore and Co. (B-M), and PPG Architectural Coatings. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

1. Proprietary names used to designate materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products or other manufacturers.

2.4 INTERIOR PAINT SYSTEMS

A. Concrete Walls, Normal Exposure (Smooth/Non-Porous): Semi-Gloss, Water-Based Light Industrial Coating System.

1. Primer for unpainted surfaces, One Coat:

a. (S-W) Loxon Masonry Primer (A24W08300).
b. (B-M) Ultra Spec Interior/Exterior Acrylic High Build Masonry Primer (609).

2. Primer for previously painted surfaces, One Coat:

a. (S-W) Extreme Bond Primer (B51W00150).
b. (B-M) Corotech Waterborne Bonding Primer (V175).

3. Finish, Two Coats

a. (S-W) Pro Industrial Pre-Catalyzed Water Based Epoxy (K46W01151).
b. (B-M) Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss (V341).

B. Concrete Masonry Units, Normal Exposure: Semi-Gloss, Water-Based Light Industrial Coating System.

1. Primer for unpainted surfaces, One Coat:

a. (S-W) PrepRite Block Filler (B25W00025).
b. (B-M) Corotech Acrylic Block Filler (V114).

2. Primer for previously painted surfaces, One Coat:

a. (S-W) Extreme Bond Primer (B51W00150).
b. (B-M) Corotech Waterborne Bonding Primer (V175).

3. Finish, Two Coats:

a. (S-W) Pro Industrial Pre-Catalyzed Water Based Epoxy (K46W150).
b. (B-M) Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss (V341).

C. Concrete Floors: Water Based Epoxy System (Standard duty).

1. Finish, Two Coats:

a. (S-W) ArmorSeal 8100 Water Based Epoxy Floor Coating, Satin (B70W08161).
b. (B-M) Insl-X Garage Guard Waterborne Epoxy Garage Floor Coating EGG-XXX Semi-Gloss.

D. Ceilings: Flat, Acrylic Latex (Zero VOC) System.

1. Primer for unpainted surfaces, One Coat:

a. (S-W) ProMar 200 Zero VOC Interior Latex Primer (B28W02600).

b. (B-M) Ultra Spec 500 Interior Latex Primer (N534).

2. Primer for previously painted surfaces, One Coat:

a. (S-W) Extreme Bond Primer (B51W00150).
b. (B-M) Stix Waterborne Bonding Primer (SXA-100).

3. Finish, Two Coats:

a. (S-W) ProMar 200 Zero VOC Interior Latex Flat (B30W02651).
b. (B-M) Ultra Spec 500 Interior Latex Flat (N536).

4. Finish, Two Coats (For High Moisture Environments, e.g. Natatoriums):

a. (S-W) Pro Industrial Water Based Catalyzed Epoxy Eg-Shel (B73-300).
b. (B-M) Corotech Waterborne Amine Epoxy (V440).

E. Gypsum Board and Plaster Walls and Ceilings: Eggshell, Acrylic Latex (Zero VOC).

1. Primer for unpainted surfaces, One Coat:

a. (S-W) Pro Mar 200 Zero VOC Primer (B28W2600).
b. (B-M) Ultra Spec 500 Interior Latex Primer (N534).

2. Primer for previously painted surfaces, One Coat:

a. (S-W) Extreme Bond Primer (B51W00150).
b. (B-M) Stix Waterborne Bonding Primer (SXA-100).

3. Finish, Two Coats:

a. (S-W) ProMar 200 Zero VOC Interior Latex (B20W01951).
b. (B-M) UltraSpec 500 Interior Eggshell Finish (N538).

F. Ferrous Metal: Semi-Gloss, Acrylic Finish (Less than 100g/L VOC system).

1. Primer for unpainted surfaces, One Coat:

a. (S-W) Pro Industrial Pro-Cryl Universal Acrylic Primer (B66W01310-1).
b. (B-M) Ultra Spec HP Acrylic Metal Primer (HP04).

2. Finish, Two Coats:

a. (S-W) Pro Industrial Acrylic Semi-Gloss (B66W00651-16).
b. (B-M) Ultra Spec Acrylic DTM Enamel Semi-Gloss (HP29).

G. Galvanized Metal: Semi-Gloss, Acrylic Finish (Less than 100g/L VOC system).

1. Primer for unpainted surfaces, One Coat:

a. (S-W) Pro Industrial Pro-Cryl Universal Acrylic Primer (B66W1310-16).
b. (B-M) Ultra Spec HP Acrylic Metal Primer (HP04).

2. Finish, Two Coats:

a. (S-W) Pro Industrial Acrylic Semi-Gloss (B66W00651-16).
b. (B-M) Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel (HP29).

H. Steel Roof Decking, Structure, and MEP Systems: Semi-Gloss, Acrylic Finish (Less than 100g/L system)

1. Primer, One Coat (Primer may be eliminated if the decking and steel is factory or shop primed, or previously painted).

a. (S-W) Pro Industrial Pro-Cryl Universal Acrylic Primer (B66W01310-16).
b. (B-M) Ultra Spec HP Acrylic Metal Primer (HP04).

2. Finish: Two Coats:

a. (S-W) Waterborne Acrylic Dryfall (B42W00181).
b. (B-M) Coronado Super Kote 5000 Dry Fall Latex Semi-Gloss (112).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 SURFACE PREPARATION

A. Comply with manufacturer's written instructions and as herein specified, for each particular substrate condition. If surface preparation instructions are not available, refer to SSPC standards.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

D. Existing surfaces noted to be refinished: Remove loose material by wire brushing surfaces, sanding, and thoroughly clean surfaces ready for new finishes. Patch cracks, etc. as may be required for new finishes. Treat all existing surfaces to be repainted as new work and match existing adjacent finishes.

1. Clean to SSPC standards - SSPC-SP2.

E. Cementitious Materials: Prepare surfaces of concrete and concrete block, to be painted by removing efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze.

1. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.
2. Clean to SSPC standards - SSPC-SP13 or ICRI CSP 1-9.

F. Wood: Clean wood surfaces 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 thin coat of white shellac or other recommended knot sealer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood. When transparent finish required, use spar varnish for backpriming.

G. Ferrous Metals: Clean ferrous surfaces, which are not shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent (SSPC-SP1) or mechanical cleaning (SSPC-SP2 and SP3).

1. Touch-up shop applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

H. Galvanized Surfaces

1. Allow new galvanized surfaces to weather as long as possible before cleaning. Remove surface contaminants using clean rags and petroleum spirits.
2. Remove "white rust" using appropriate solvent and, if necessary, wire brushing or sanding.
3. Use appropriate Structural Steel Painting Council Standard SSPC-SP1 to SSPC-SP6 to clean steel substrates where galvanized protection has been removed.

I. Aluminum

1. Non-corroded Surfaces: Rub with fine steel wool and wipe clean with mineral spirits.
2. Corroded Surfaces: Sand smooth, rub with fine steel wool and wipe clean with mineral spirits.

J. Other Substrates: See finish paint manufacturer's recommendations.

3.3 MATERIALS PREPARATION

A. Mix, prepare and store painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

A. Environmental Conditions

1. Water-based Paints: Apply when surface temperatures will be 50 degrees Fahrenheit to 90 degrees Fahrenheit throughout the drying period.
2. Other Paints: Apply when surface temperatures will be 45 degrees Fahrenheit to 95 degrees Fahrenheit throughout the drying period.
3. Apply exterior paints during daylight hours free from rain, snow, fog and mist when ambient air conditions are more than 5 degrees above the surface dew point temperature and relative humidity less than 75 percent.

    a. When exterior painting is allowed or required during non-daylight hours, provide portable outdoor weather recording station with constant printout showing hourly to diurnal air temperature, humidity, and dew point temperature.

4. Exterior Cold Weather Protection: Provide heated enclosures necessary to maintain specified temperature and relative humidity conditions during paint application and drying periods.

B. Install approved paints where specified, or shown on the drawings, and to match approved field examples.

1. Paint Applicators: Brushes, rollers or spray equipment recommended by the paint manufacturer and appropriate for the location and surface area to be painted.
2. Approved minimum wet and dry film thicknesses shall be the same for different application methods and substrates

C. Employ only skilled mechanics and apply painting and finishing materials in accordance with manufacturer's directions. Use applicators and techniques best suited for materials and surfaces to which applied.

1. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
2. Paint interior surfaces of ducts, where visible through registers or grilles, flat, black.
3. Finish exterior doors on tops, bottoms and side edges same as exterior faces.
4. Sand lightly between succeeding enamel or varnish coats.
5. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.
6. Apply each material at not less than the manufacturer's recommended spreading rate, to provide a total dry film to thickness as recommended by manufacturer.

D. Prime Coats: Apply prime coat on material which is required to be painted or finished, and which has not been prime coated by others.

1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surfaces imperfections will not be acceptable.

F. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats, unless otherwise indicated.

G. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.5 FIELD QUALITY CONTROL

A. Each applied coat of material must be inspected and approved by the Architect or Owner's Representative before the application of the succeeding coat, otherwise no credit for the coat applied shall be given, and the contractor automatically assumes the responsibility to recoat the work in question.

B. Finish existing materials disturbed or exposed by new work to match the existing adjacent materials. Where an existing wall or ceiling is altered by new work, repaint the

entire wall from corner to corner and floor to ceiling, and repaint entire ceiling unless otherwise noted.

3.6 CLEAN-UP AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. Porcelain-enamel markerboards (MB)

B. Wood trim is specified in Section 062000 Finish Carpentry

1.3. QUALITY ASSURANCE:

A. Manufacturer: Furnish all chalkboards, tackboards, and markerboards by a single manufacturer for the entire project.

1.4. ACTION SUBMITTALS:

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

1. Include[rated capacities, operating characteristics, electrical characteristics and] individual panel weights for sliding visual display units.
2. Include computer system requirements for electronic markerboards.
3. Various Sources Using Small-Scale Environmental Chambers."

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Show locations of special-purpose graphics for visual display surfaces.
3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes.

1.5. INFORMATIONAL SUBMITTALS:

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

C. Warranties: Sample of special warranties.

1.6. CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7. SPECIAL PROJECT WARRANTY:

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Claridge Products and Equipment, Inc.
2. Polyvision a Steelcase Company

2.2. MATERIAL:

A. Porcelain Enamel Markerboard: Provide balanced, high pressure laminated porcelain enamel markerboards of 3-ply construction consisting of facing sheet, core material and backing.

1. Facing Sheet: Provide facing sheet of 24-gauge enameling grade steel sheet especially processed for temperatures used in coating porcelain on steel. Coat the exposed face with a 3-coat process consisting of primer, ground coat and color cover coat, and the concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to the steel at the manufacturer's standard firing temperatures, but not less than 1,200°F.

a. Proprietary Facing Sheet: At the contractor's option provide LCS 24ga Porcelain Enamel Steel Markerboard as manufactured by Claridge Products and Equipment, Inc., in lieu of the facing sheet construction specified above. Fuse porcelain enamel coating to sheet facing steel at approximately 1,000F.

2. Cover Coat: Provide the manufacturer's standard matte finish cover coat, color as selected from the manufacturer's standards. Provide boards with staff lines where indicated.
3. Core: Provide the manufacturer's standard 3/8" minimum thick particleboard core material complying with the requirements of ANSI A208.1, Grade 1-M-1., made with binder containing no urea formaldehyde , that complies 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."

4. Backing Sheet: Provide the manufacturer's standard 0.015" thick aluminum sheet backing.
5. Laminating Adhesive: Provide the manufacturer's standard moisture-resistant thermoplastic type adhesive.
6. Adhesives: Manufacturer's standard product that complies 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."

B. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062" thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single length units wherever possible; keep joints to a minimum. Metal frame shall be a continuous one-piece from jamb to head to jamb and at corners. The outstanding legs shall be mitered to a neat, hairline closure.

1. Clear Anodized Finish: Furnish exposed aluminum trim, accessories and fasteners with the manufacturer's standard satin anodized finish with clear anodic coating complying with AA requirements for Class II Architectural Coating (AA-A31).
2. Chalktrough: Furnish the manufacturer's standard continuous; hollow chalktrough with cast aluminum end closures (Series 1 - Claridge) (CR-55 Polyvision).
3. Map Rail: Furnish map rail at the top of each unit, surface mounted and continuous from jamb trim to jamb trim, complete with the following accessories:

    a. Display Rail: Provide continuous cork display rail approximately 2" wide, as indicated, integral with the map rail.
    b. End Stops: Provide one end stop at each end of the map rail.
    c. Map Hooks: Provide 2 map hooks for each 4' of map rail or fraction thereof.
    d. Flagholders: Provide one for each classroom.

4. Markerboard: Provide manufacturer's standard dry erase kit for each room where markerboard is specified.

2.3. FABRICATION:

A. Porcelain Enamel Chalkboards and Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Assembly: Provide factory assembled chalkboard, tackboard and markerboard units, except where field assembled units are required.

1. Provide manufacturer's standard vertical joint system between abutting sections of chalkboard, tackboard and markerboard.

PART 3 - EXECUTION

3.1. INSTALLATION:

A. Deliver factory-built chalkboard, tackboard and markerboard units completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide 2 pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit at factory, disassembled for delivery, and make final joints at site. Use splines at joints to maintain surface alignment.

B. Install units in locations and mounting heights as shown on drawings and in accordance with manufacturer's instructions, keeping perimeter lines straight, plumb, and level. Provide all clips, backing materials, brackets, anchors, trim, and accessories for complete installation.

3.2. ADJUST AND CLEAN:

A. Verify accessories required for each unit properly installed and operating units properly functioning.

B. Clean units in accordance with manufacturer's instructions, breaking in only as recommended. Protect from damage and soiling by covering with paper until building is completed.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of signs:

B. Room-identification signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have been regularly producing signs similar to those specified for the Work, for a minimum of 5 years. Manufacturer shall also have sufficient production capacity to produce the quantity of sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

1.7 FIELD CONDITIONS

A. Take field measurements and check field conditions prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements and conditions on shop drawings.

B. Do not install the sign units until all other finishing operations, including painting, have been completed unless otherwise directed.

1.8 DELIVERY, STORAGE, AND HANDLING:

A. Deliver sign units to Site with protective covering in place.

B. Leave protective covering on sign units until completion of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Mohawk Sign Systems, Inc., Schenectady, NY 12301; www.mohawksign.com.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 MATERIALS

A. Plaque Material: Provide ES plastic laminate, 1/8-inch thick with contrasting core color. The ES plastic laminate shall be non-static, fire-retardant and self-extinguishing. The plastic laminate must be impervious to most acids, alkalis, alcohol, solvents, abrasives and boiling water.

1. Finish and Color: As selected from manufacturer's standard colors and finishes, unless otherwise indicated.
2. Thickness: 1/8-inch, unless otherwise indicated.

2.4 GRAPHIC PROCESS

A. All signs shall be manufactured using Graphic Process Series 200A - Sand Carved.

1. Tactile characters/symbols shall be raised the required 1/32-inches from sign face. Glue-on letters are not acceptable.
2. All text shall be accompanied by Grade 2 Braille.
3. Perimeter borders shall be 3/8-inch.
4. All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

B. Letter form shall be Helvetica Medium upper case.

C. Size of letters and numbers shall be as follows:

1. Room numbers shall be 1-inch.
2. Lettering for room ID signs shall be 5/8-inch minimum.
3. Symbols size shall be 3-inch.
4. Standard Grade 2 Braille shall be below all copy.

2.5 SIGN SIZE

A. See diagrams at end of Section for sign size and style.

2.6 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's full range; (4) different colors will be required.

2.7 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, with adhesive on both sides

B. Adhesive: As recommended by sign manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb and with sign surfaces free from distortion or other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Signs to be mounted with Braille between 48- and 60-inches off finished floor (see sign types for mounting heights of signs) to the top of the sign and near latch side (minimum of 9-inches to center of sign from edge of door) for single doors and adjacent to the right door for double doors out of the path of the door swing."

B. Mounting Methods:

1. Vinyl foam tape/silicone adhesive ("SAM") mounting unless noted otherwise.

3.2 CLEANING AND PROTECTION

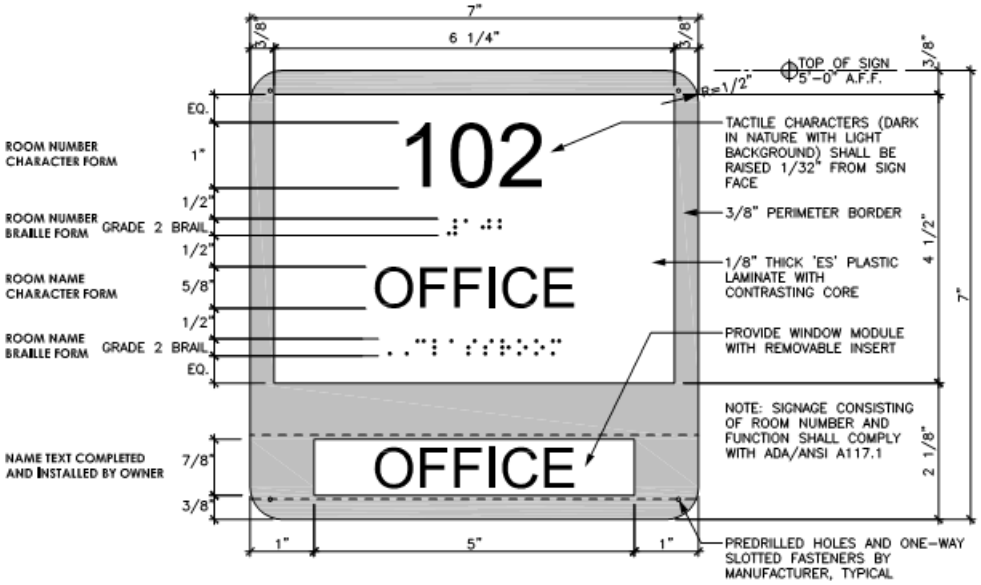
A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.3 SIGNAGE SCHEDULE

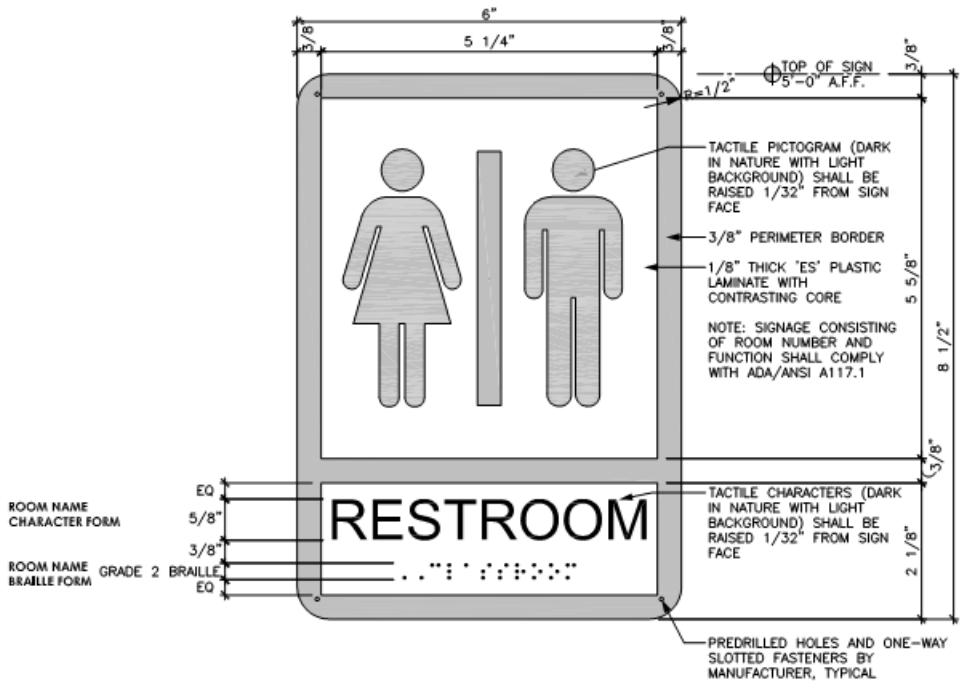
A. Provide interior signage in the quantities indicated. Exact locations to be determined in the field by architect unless otherwise noted:

1. Sign Type 1: 10
2. Sign Type 2: 5
3. Sign Type 3: 5

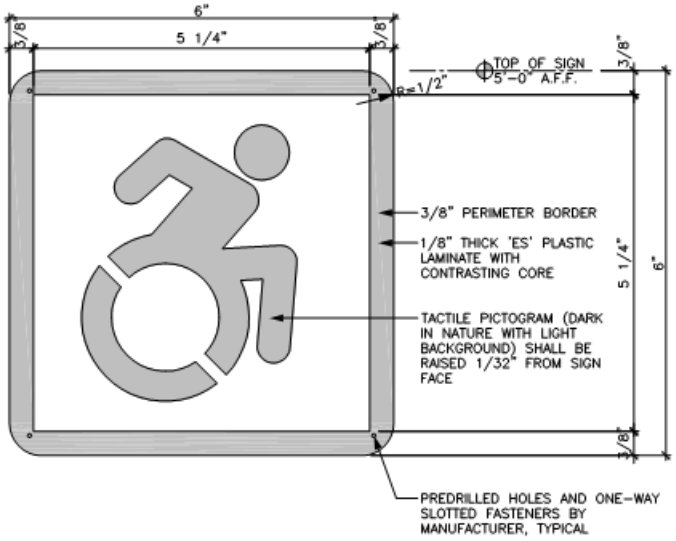
3.4 SIGN TYPES



SIGN TYPE 1



SIGN TYPE 2



SIGN TYPE 3

END OF SECTION

SECTION 102226 - OPERABLE PARTITIONS

PART 1. GENERAL

1.1. RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY:

A. Section Includes:

1. Manually operated, acoustical panel partitions.

1.3. PREINSTALLATION MEETINGS:

A. Preinstallation Conference: Conduct conference at Project site.

1.4. ACTION SUBMITTALS:

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.

1.5. INFORMATIONAL SUBMITTALS:

A. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

B. Qualification Data: For qualified Installer, manufacturer and vendor.

C. Product Certificates: For each type of operable panel partition.

1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.

D. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

E. Sample Warranty: For manufacturer's special warranty.

1.6. CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7. MAINTENANCE MATERIAL SUBMITTALS:

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.8. QUALITY ASSURANCE:

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9. DELIVERY, STORAGE, AND HANDLING:

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.10. WARRANTY:

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period: **Two** years from date of Substantial Completion.

PART 2. PRODUCTS

2.1. PERFORMANCE REQUIREMENTS:

A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2. OPERABLE PANELS:

A. Operable Panels: Acoustical panel partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Basis-of-Design Product: Subject to compliance with requirements, provide: Acousti-Seal #912, manually operated paired panel operable partition, as manufactured by Modernfold, Inc.

   a. Substitutions in accordance with Section 016000.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable fire-rated panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Equal widths.

E. STC: Not less than 52.

F. Panel Weight: 10 lb/sq. ft.

G. Panel Thickness: Not less than 3 inches.

H. Panel Materials:

1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.

I. Panel Closure: Manufacturer's standard closure unless otherwise indicated.

1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
2. Final Closure: Fire-rated, constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

J. Hardware: Manufacturer's standard as required to operate fire-rated operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

2.3. SEALS:

A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous PVC acoustical seal.

C. Horizontal Top Seals: manufacturer's standard.

D. Horizontal Bottom Seals: Modernfold IM2 Bottom Seal. Manually activated bottom seals with self-contained handle providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to -1-1/2 inch (38 mm). Seal shall be operable from panel edge or face.

2.4. PANEL FINISH FACINGS:

A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

B. Panel Finish: Full height steel markerboard work surface.

C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5. SUSPENSION SYSTEMS:

A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

1. Multidirectional Carriers: Capable of negotiating intersections without track switches.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

1. Curve-and-Diverter Switches: Allow radius turns to divert panels to an auxiliary track.
2. L Intersections: Allow panels to change 90 degrees in direction of travel.
3. T Intersections: Allow panels to pass through or change 90 degrees to another direction of travel.
4. X Intersections: Allow panels to pass through or change travel direction full circle in 90-degree increments, and allow one partition to cross track of another.
5. Multidirectional Switches: Adjustable switch configuring track into L, T, or X intersections and allowing panels to be moved in all pass-through, 90-degree change, and cross-over travel direction combinations.
6. Center carrier stop.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6. ACCESSORIES:

A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.

1. Manufacturer's standard method to secure storage pocket door in closed position.

PART 3. EXECUTION

3.1. EXAMINATION:

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. INSTALLATION:

A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3. ADJUSTING:

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust storage pocket doors to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.

3.4. MAINTENANCE SERVICE:

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.5. DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
   1.
   2. Sanitary napkin disposal units.
   3. Grab bars.
   4. Mirrors.
   5. Double Coat/Robe Hooks.
   6. Paper towel dispenser, Toilet paper holders, and Soap dispensers will be furnished by owner and installed under this section

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Samples: Full size, for each exposed product and for each finish specified.

   1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For Manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Parts list.

C. Keys and tools.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's original protective packaging.

1. Furnish items with protective wrappings or covers as required to protect finishes. Do not remove protective coverings until completion of other Work liable to damage accessory finish.
2. Pack products with required trim, mounting devices, fasteners, service tools or keys, and complete installation instructions.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide toilet accessories by one of the following:

1. Toilet Accessories:

a. American Specialties, Inc. (Basis of Design).
b. Bradley Corporation.
c. Bobrick, Inc.

2.2 MATERIALS, GENERAL

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Aluminum: Alloy 6063-T5.

C. Mirror Glass: ASTM C 1048, Kind FT (fully tempered), Type I, Class 1 (clear), Quality-Q2, with silver coating, copper protective coating, and non-metallic paint coating.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.3 FABRICATION

A. General: Stamped names or labels on exposed faces of toilet accessory units are not permitted, except where otherwise indicated; unobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required, provide same keying throughout project. Furnish two keys for each lock.

1. Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

2.4 PAPER TOWEL DISPENSER – "PTD"

A. Install unit furnished by owner

2.5 SANITARY NAPKIN DISPOSAL - SURFACE MOUNTED UNIT – "SNDM"

A. Surface Mounted Sanitary Disposal Unit: Stainless steel, No. 4 finish (satin). Door shall be equipped with a tumbler lock. Unit shall have a self-closing panel covering disposal opening. Panel shall be secure to door with a spring-loaded, full-length stainless steel piano hinge and equipped with an international graphic symbol identifying usage. Napkin disposal shall be furnished with a removable, leak-proof molded polyethylene receptacle. Minimum capacity: 1.2 gallons.

1. Product: ASI 0473-A.

2.6 TOILET PAPER HOLDER – "TPH"

A. Install unit furnished by owner.

2.7 TOILET PAPER HOLDER – "TPH"

A. Install unit furnished by owner.

2.8 GRAB BARS – "GBA," "GBB," "GBC" and "GBD"

A. Grab Bars: Stainless steel, No. 4 finish (satin); 1-1/2-inch outside diameter with wall thickness not less than 0.05-inch; concealed mounting with manufacturer's standard flanges and anchorage devices as required by substrate. Provide 1-1/2-inch clearance between wall surface and inside face of bar.

1. Product: ASI-3800 (36-inches for stalls, 24-inches for private toilets) for Type "GBA" above water closet.
2. Product: ASI-3800 (42-inches) for Type "GBB" on side wall adjacent to water closet.

3. Product: ASI-3800 (18-inches) for Type "GBC" on side wall adjacent to water closet, 39-inches to 41-inches from rear wall].
4. Product: ASI-3874 (33-inches by 18-inches) for Type "GBD" for 36-inch by 36-inch shower stall.

2.9 SOAP DISPENSER – "SD"

A. Install unit furnished by owner.

2.10 MIRROR UNITS – "M1"

A. Standard Mirror "M1": Mirror shall be framed with one-piece, stainless steel, No. 4 finish (satin), 3/4-inch by 3/4-inch angle. Frame shall be roll-formed construction. Frame shall have flat design on front of angle to hold mirror tightly against frame to prevent exposure to sharp edges. Corners shall be welded, ground, and polished smooth. Mirror shall be 1/4-inch tempered glass. Provide galvanized steel backing sheet and non-absorptive filler material.

1. Product: ASI-0600 series, sizes as shown on drawings.

B. Mirror Hangers: Concealed, rigid, tamperproof, theft proof mounting system consisting of one-piece galvanized steel wall hangers and allen screw type locking mechanism.

2.11 DOUBLE COAT/ROBE HOOK – "CH"

A. Double Coat/Robe Hook: ASI 7345-S.

1. Description: Double-prong unit.
2. Material and Finish: Stainless steel, No. 4 finish (satin).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes fire extinguisher cabinets.

1. Type ABC multi-purpose fire extinguishers complying with NFPA 10 will be supplied by Owner.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-extinguisher cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1.4 CLOSEOUT SUBMITTAL

A. Maintenance Data: For fire-extinguisher cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1

A. Fire-Rated Fire-Extinguisher Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. JL Industries.
2. Larsen's Manufacturing Company.
3. Nystrom Inc.

2.3 FIRE EXTINGUISHER CABINET

A. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Inside Dimensions (Nominal): 12-inches wide by 27-inches high by 8-inches deep.
2. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
3. Rolled-Edge Trim: 2-1/2-inch backbend depth.

B. Cabinet Construction:

1. At nonrated walls: Nonrated.
2. At fire-rated walls: Cabinets to match fire-resistance rating of walls where they are installed.

a. Construct fire-rated cabinets with double walls fabricated from 0.043-inch thick cold-rolled steel sheet lined with minimum 5/8-inch thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

D. Cabinet Trim Material: Steel sheet.

E. Door Material: Steel sheet.

F. Door Style: Fully glazed panel with frame.

G. Door Glazing: Tempered float glass (clear).

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch, or projecting or recessed door pull and friction latch.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

I. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

a. Identify existence of fire extinguisher in cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Silk-screened.
3) Lettering Color and Orientation: As selected by Architect from manufacturer's standard colors/arrangements.

J. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel or powder coat.
b. Color: As selected by Architect from full range of industry colors and color densities.

2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. Fire-Extinguisher Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-extinguisher cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-extinguisher cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semi-recessed fire-extinguisher cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-extinguisher cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Securely fasten cabinets to structure, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-extinguisher cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-extinguisher cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-extinguisher cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-extinguisher cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-extinguisher cabinet and mounting bracket manufacturers.

E. Replace fire-extinguisher cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Athletic/Gym/Team Lockers.
2. Locker room benches.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples for Initial Selection (for units with factory-applied color finishes): Manufacturer's color charts showing the full range of colors available.

D. Samples for Verification: For metal lockers and locker benches, in manufacturer's standard sizes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Manufacturer and Installer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.7 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. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than [**5**] units:

a. Locks.
b. Identification plates.
c. Hooks.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing metal lockers of the type required for this project, with minimum 10 years documented experience.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project, with minimum 10 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.11 COORDINATION

A. Coordinate sizes and locations of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.

b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

1.13 ACCESSIBILITY

A. 5 percent of all lockers to be handicapped accessible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. List Industries.

a. Basis of Design: Athletic/Gym/Team Lockers: "Superior Fully-Framed All-Welded Marquis Champion Athletic Lockers."

B. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

C. Lockers shall be GREENGUARD Gold Certified by UL Environment through the GREENGUARD Certification Program.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers and benches indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications

B. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch steel mesh, with at least 70 percent open area unless otherwise indicated.

C. Fasteners: Zinc, or nickel plated steel; exposed bolt heads, slotless type; self-locking nuts or lock washers for nuts on moving parts.

D. Equipment: Hooks and hang rods of zinc-plated steel or cast aluminum.

2.4 FABRICATION, GENERAL

A. Construction: Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make all exposed metal edges safe to touch. Fabricate lockers with all steel members welded together to form rigid, one-piece structure. Weld all connections. Use of fasteners shall not be permitted. Grind all welds smooth.

B. Finishing: Chemically pretreat metal with degreasing and phosphatizing process. Apply baked enamel or powder coat finish to all surfaces, exposed and concealed, except plates and non-ferrous metal.

1. Color: Provide locker units in 2 colors as selected by Architect from manufacturer's standard selection.

C. Height: All locker units shall be 72 inches, with sloped tops projecting above the top of the lockers.

2.5 ATHLETIC/GYM/TEAM LOCKERS

A. Construction: Comply with the following:

1. Frame / Vertical Side panels: Shall be of 13 gauge 1/2- inch flattened expanded metal framed by 16 gauge Hollow "T" tubular sections and channel frame members designed to enclose all four edges of the side panel with the entire assembly MIG welded to form a rigid frame for each locker. The channel frame members are to be welded to the front and rear vertical frame members to create and anchor bearing surface of 1-1/4 inches wide by the depth of the locker at each side panel.
2. Integral Frame Locker base: 14 gauge formed structural channels are to be MIG welded to the front and rear vertical side panel frame members to allow placement of locker bottom a minimum 2-3/4 inches above floor level. Locker bottom shelf located less than 2- inches above floor level is not acceptable.
3. 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 inch wide 18 gauge full height channel door stiffener MIG welded to the hinge side of the door as well as to the top and bottom door return bends and spot welded to the inside of door face to form a rigid torque-free box reinforcement for the door. All doors shall be right hand side hinged. Wardrobe doors 20 inches high and over to be perforated with 5/8- inch by 1-1/2 inch diamonds. Gym doors 18 inches high and under to be perforated with 7/16- inch by 15/16- inch diamonds.
4. Recessed Locker Handle: All locker doors shall have a seamless drawn, not less than Type 304 stainless steel, 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. The pull handle shall be drawn into the left side of the handle for easy opening of the locker door.
5. Latch Assembly: Shall be single point rigid non-moving positive latch by means of a heavy gauge (minimum 11 gauge) latch securely welded to the framed vertical divider. The latch assembly must be made of a single piece of steel and have a padlock loop that inserts 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 riveted to the door strike.

6. Door Hinges: Hinges shall not be less than 3-1/2 inches long 13 gauge seven knuckle pin type, securely riveted to frame and welded to the door. Doors are to be secured to frame with a minimum of two tamper resistant rivets per hinge. Provide 3 hinges for doors 48 inches and higher and 2 for doors shorter than 48 inches. All doors shall be right hand side hinged.
7. Flat Tops: Shall be formed of one piece of 16 gauge cold rolled sheet steel and shall be an integral part MIG welded to each vertical side panel frame member and be continuous to cover the full width of a multiple framed locker unit.
8. Hat Shelves, Intermediate Shelves and Bottoms: Shall be 16 gauge galvanneal sheet steel, have double bends at front and shall engage slots in the Hollow "T" vertical frame members at all four corners and be securely welded to the frame and side. Locker bottom shelf located less than 2- inches above floor level is not acceptable.
9. 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 frame member.
10. Locks (master-keyed to one system for the entire project):

    a. Master No. 1525, or equal, shackle padlock for each locker door.
    b. Master No. 2650, or equal, ADA-Inspired Portable Lock, Keyed Padlock for each locker door.
    c. Provide Master No. 1690, or equal, built-in combination, for each locker door.
    d. ADA-Compliant Locks: Provide Master No. 1695MKADA, or equal, built-in combination, for each locker door.

        1) Provide all required keys to make lock completely operation.

11. Equipment: Furnish each locker with the following items, unless otherwise shown.

    a. Single tier lockers: Openings 60 and 72 inches shall include one galvanneal hat shelf, one double prong ceiling hook and a minimum of two single prong wall hooks.
    b. Double and Triple tier lockers: Openings 20 thru 36 inches high shall include one double prong ceiling hook and a minimum of two single prong wall hooks.
    c. Box lockers: No hooks

2.6 LOCKER ACCESSORIES

A. Number Plates: Manufacturer's standard etched, embossed, or stamped, non-ferrous metal number plates with numerals not less than 3/8- inches high.

B. Continuous Sloping Tops: Not less than 20 gauge sheet steel, approximately 20 deg pitch, in lengths as long as practicable but not less than 4 lockers. Provide closures at ends and at backs where exposed in free standing rows of lockers. Finish to match lockers, unless otherwise indicated.

C. Filler Panels: Provide filler panels where indicated, and as required, of not less than 18 gauge steel sheet, factory-fabricated and finished to match locker units.

D. Exposed End Panels: Solid phenolic-core panel material with melamine facing fused to substrate during panel manufacture (not separately laminated).

1. Fire Resistance: Class C in accordance with ASTM E 84 - Flame spread of 76-200 and smoke developed less than 450.
2. Panel Thickness: 3/4- inch.

    a. Provide one-piece panels for double-row (back-to-back) locker ends.

3. Exposed Panel Color: As selected by Architect from manufacturer's full range.
4. Panel Edging: Fully welded, 16 gauge steel C-Channel at perimeter of panels.

    a. Edging Color: As selected by Architect.

2.7 LOCKER ROOM BENCHES - ADA

A. Manufacturer's standard units with seat height of 17-1/2 inches.

B. Bench Seat: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Seat: 42 inches wide by 20 inches deep.
2. Material: Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Fixed Pedestals: Manufacturer's standard supports, four per bench, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel: 1-1/2- inch-diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; concealed floor fastening with 1/2- inch by 5-1/2- inch stainless steel wedge anchors; baked-enamel or powder-coat finish.

    a. Color: As selected by Architect from manufacturer's full range.

D. Brackets: Two steel back brackets per bench. Color to match fixed pedestals.

E. Materials:

1. Steel Tube: ASTM A 500/A 500 M, cold rolled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers in sequence as directed by the Architect.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.

E. Replace defective or damaged doors or other components as directed by the Architect.

F. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes. Replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 122413 - WINDOW SHADES

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. Manually operated roller shades with single rollers.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Attendees: The Contractor, Owner/Owner's Representative, Architect, and the installer shall attend the meeting. The Contractor shall advise all attendees of the scheduled Pre-installation Conference date.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

F. Roller-Shade Schedule: For roller shades. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.7 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation

conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BTX Window Automation, Inc.
2. DFB Sales Inc.
3. Draper Inc.
4. Hunter Douglas Contract.
5. Lutron Electronics Co., Inc.
6. MechoShade Systems, Inc.
7. OEM Shades Inc.
8. Silent Gliss USA, Inc.
9. SM Automatic, Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Clip, jamb mount.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of inside face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 4 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: Fiberglass with acrylic backing.
3. Thickness: Manufacturer’s standard.
4. Weight: Manufacturer’s standard.
5. Roll Width: Manufacturer’s standard width as required to minimize shadeband seams. Uniformly distribute seams in shadeband.
6. Orientation on Shadeband: As recommended by manufacturer relative to required shade size. All shades within individual rooms shall have same shadeband orientation.
7. Features: Antistatic treatment.
8. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

D. Provide decal or label on interior face of shadeband indicating "Emergency Rescue Window" on all shades installed at Emergency Rescue Window locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
2. DO NOT fasten shades and shade hardware to door and window frames, aluminum storefront framing, or aluminum curtain wall framing without prior approval from Architect.

B. Roller Shade Locations: At exterior windows.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pre-engineered canopies at building entrance as indicated on the Drawings.

1.2 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Illustrate products, installation, and relationship to adjacent construction.
2. Product Data: Manufacturer's descriptive data and product attributes.
3. Samples: Color Chips

B. Delegated Design Submittal: For fabricated canopies.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Informational Submittals:

1. Certificate of Compliance: Certification that installed products meet specified design and performance requirements.
2. Qualification Data:

a. For Manufacturer and Installer
b. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design loads: As indicated on Drawings and in accordance with ASCE 7 and the 2020 Building Code of New York State.
2. Design steel in accordance with AISC Steel Construction Manual.
3. Movement: Ambient temperature range of 120 degrees F and a surface temperature range of 160 degrees F.
4. System design to be performed by qualified professional engineer licensed in State of New York.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Approved by Manufacturer and having at least 10 years' experience installing canopies or similar structures in type and size to this project.

B. Manufacturer Qualifications: Minimum 10 years' experience manufacturing canopies similar in type and size to this project.

1.5 WARRANTIES

A. Fabricated Structures: Manufacturer's 10-year warranty against defects in materials and workmanship.

B. Powder Coatings: Manufacturer's 10-year warranty against peeling or fading in excess of 8 percent of total coated surface.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: CEAS+, www.ceasplus.com

1. Contact: Brad Fritz, CEAS, brad.fritz@portercorp.com.

B. Substitutions: In accordance with section 016000

2.2 MATERIALS

A. Steel:

1. Shapes, bars, and plates: ASTM A36/A36M, ASTM A572/A572M, or ASTM A992.
2. Hollow structural sections: ASTM A500/A500M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Roof Decking:

1. Type: Nominally 2 x 6 inch Hem-Fir, tongue-and-groove, factory stained.
2. Color: To be selected from manufacturer's full color range.

D. Roofing:

1. Type: Preformed 24 gage steel, standing seam profile.
2. Finish: AAMA 2605, fluoropolymer coating containing minimum 70 percent PVDF resins.
3. Color:

a. Top surface: To be selected from manufacturer's full color range.
b. Bottom surface: Off-white.

2.3 ACCESSORIES

A. Anchors: ASTM F1154 GR55 hot-dip galvanized anchor rods (per ASTM F2329).

B. Gutters: PoliGuard Rain Gutter System by CEAS+. Include all components required for a complete and functioning gutter and downspout system.

2.4 FABRICATION

A. Fabricate components in accordance with AISC Steel Construction Manual and approved Shop Drawings.

B. Welding to conform to AWS D1.1/D1.1M.

C. Column Style: Rectangular

D. Electrical Cutouts: Provide cutouts for electrical access at locations indicated.

2.5 FINISHES

A. Steel: Poli-5000 polyester powder coat finish:

1. Steel shall be cleaned, pretreated, and finished at a facility owned and directly supervised by the manufacturer.
2. Steel shall be shot blasted to SSPC-SP10 near-white blast cleaning. SSPC-SP2 hand tool cleaning will not be an acceptable alternative.
3. Parts shall be pretreated in a (3) stage iron phosphate or equal washer.
4. Epoxy primer powder coat shall be applied to parts for superior corrosion protection.
5. Topcoat of Super Durable TGIC powder coat shall be applied over the epoxy primer.
6. Finish shall not have any VOC emissions.
7. Sample production parts shall have been tested and meet the following criteria:

    a. Salt spray resistance per ASTM B 117/ ASTM D 1654 to 10,000 hours with no creep from scribe line and rating of 10.
    b. Humidity resistance per ASTM D2247-02 to 5,000 hours with no loss of adhesion or blistering.
    c. Color/UV resistance per ASTM G154-04 to 2,000 hours exposure, alternate cycles with results of no chalking, 75% color retention, color variation maximum 3.0 E variation CIE formula (before and after 2,000 hours exposure).

8. The manufacturer shall be PCI 4000 S Certified
9. Exposed fasteners for frame and ornamentation shall be powder coated to match structure.

B. Color to be selected from manufacturer's full color range, smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Installation Tolerances:

1. Maximum variation from plane: 1/8 inch in 3 feet or 1/4 inch in any 10 feet, whichever is less.
2. Maximum misalignment of members abutting end to end: 1/32 inch.

C. Coordinate with Electrical Contractor for wire runs

END OF SECTION

SECTION 311201 - SITE PREPARATION

PART 1. GENERAL

1.1. RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in Division 31, 32 and 33.

1.2. DESCRIPTION OF WORK:

A. The extent of site preparation is shown on the drawings.

B. Site preparation work includes, but is not limited to, the following:

1. Site investigation and underground utility identification
2. Protection of existing trees, shrubs, ground covers and lawns to remain
3. Topsoil stripping and stockpiling on site (See Section 329201)
4. Site clearing and removals
5. Temporary construction fences and gates
6. Asphalt milling
7. Saw cutting
8. Relocations/salvaged materials
9. Clean up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.3. RELATED WORK SPECIFIED ELSEWHERE:

A. Section 015000 - Temporary Facilities and Controls

B. Section 312201 - Site Earthwork

C. Section 329201 –Sodded Lawns

D. Section 334001 - Storm Drainage

1.4. SITE INVESTIGATION:

A. The Contractor shall visit the site before bidding, inform and familiarize themselves of all site conditions, including but not limited to, site topsoil, sub-soil, rock, subsurface and groundwater conditions affecting proposed work. No allowance or additional cost will be made in the work of this contract for failing to determine overall project site conditions.

B. Verify locations and protect utilities and structures, whether or not shown on the drawings. Existing utilities and structures shown on the drawings are for the Contractor's convenience and locations are not guaranteed.

C. Verify survey information given on drawings. Walk the site with the Owner's Facilities Management Personnel to discuss approximate locations of reputed utilities not shown on the survey, prior to performing work. Notify the Architect of

any and all discrepancies prior to commencing work. Commencement of work will be construed as complete acceptance of survey information.

D. Locate and protect from disturbance existing survey monuments, pins, markers and benchmarks whether or not shown on drawings. When any disturbance or damage occurs, notify Architect in writing within 24 hours. Describe nature of disturbance or damage and date first occurred. Provide copies to applicable government and municipal agencies. Pay costs for restoring monument to satisfaction of said agencies, at no additional expense to the Owner.

1.5. JOB CONDITIONS:

A. The terms "Architect" and "Landscape Architect" for Divisions 31, 32 and 33 work shall mean Appel Osborne Landscape Architecture, 102 West Division St., Suite 100, Syracuse, NY 13204, Tel. (315) 476-1022, or other representative(s) that Mosaic Associates may determine.

B. Examine drawings and specifications for the entire project. Become familiar with the scope and sequencing of work required. Coordinate and cooperate with other Contractors and trades working in and adjacent to the project.

C. Examine work prepared prior to this contract. Commencement of work will be construed as complete acceptance of all preparatory work by others.

D. Obtain and pay for permits required by authorities. Perform the work in compliance with applicable standards, codes and requirements of governing authorities having jurisdiction.

E. Safety is the sole responsibility of the Contractor.

F. Burning on site and use of explosives are not permitted.

G. Responsibility for existing utilities:

1. Contact Dig Safely New York at least two (2) full working days, and not more than ten (10) working days, before digging begins or as required by latest state law. Locate by hand excavation and provide protection from damage to existing utilities to remain in the area. (Tel. 811)
2. Existing utilities encountered within excavated areas shall be supported, blocked and/or braced in a manner approved by the owner of the utility. Leave supports in place to the extent required by the owner of the utility.
3. Should uncharted or incorrectly charted utilities be encountered, notify the Architect immediately for directions as to procedure.
4. Do not break utility connections without providing temporary services as acceptable to the Architect and the owner of the utility.
5. Repair and pay for damages to existing utilities as directed by utility Owner at no additional cost to the Owner.
6. Cap ends of utilities to be abandoned or removed in accordance with regulatory agencies and as directed by the Architect.

H. Provide protections and conduct operations to prevent injury and damage to persons, work of other Contractors, existing items to remain, structures, pavements, lawns, and adjacent properties.

I. Restore work damaged by this Contractor inside and outside the contract limits to the condition existing prior to the start of work, unless otherwise directed to the satisfaction of the Architect at no additional cost to the Owner.

J. Vehicular and pedestrian traffic control:

1. Maintain vehicular and pedestrian traffic during construction activities.
2. Provide alternate routes and traffic control around closed and obstructed traffic ways as required by governing regulations or the Owner.
3. Provide temporary fencing, flag persons, barricades, warning signs, and warning lights or other measures to protect the public and cause the least interruption of work.

K. Field Measurements: Take necessary field horizontal and vertical measurements required in order to perform the work and design intent shown on the drawings and outlined in the specifications. Assume complete responsibility for accuracy of such measurements and dimensions.

L. Removal of spoils, dust control, debris, snow and clean up:

1. Control air pollution caused by dust and dirt; comply with governing regulations. Water to control dust when necessary and as directed by the Architect or Certified Erosion Control Specialist. Provide water sprinkling materials, equipment and labor to prevent the nuisance of dust to the surrounding areas.
2. Legally dispose of removed and demolished items, including trash and debris, off the Owner's property, at a licensed disposal facility having adequate capacity to accept the project's waste.
3. Burning of combustible materials on the site is not permitted.
4. During the contract and at intervals as directed by the Architect, clear the site of extraneous materials, rubbish, construction waste, and debris. Leave the site in a clean, safe, neat, well-draining condition.
5. Soil and Snow Removal: Sweep roads, access ways, paved areas, and parking areas where soil, mud and debris have dropped or tracked from construction and delivery vehicles on a daily basis and as directed by the Architect or Certified Erosion Control Specialist. Remove snow and ice from roads, access ways, paved areas and parking areas utilized for site construction purposes.
6. Spoils: Remove from site and dispose when not required for fill or determined to be unsatisfactory soil material per Section 312201 - Site Earthwork.

M. Construction Review - General: Site visits will be made by the Architect to observe construction conformance to drawings and specifications. The occasional site visits by the Architect shall not be construed as supervision of construction or make them responsible for the safety programs and precautions, including but not limited to: the safe access, visit, use, work travel, or occupancy of any person. Site visits shall not make the Architect responsible for means,

methods, techniques, sequences or procedures of construction selected by the Construction Manager, Contractor or his Sub-contractors.

N. Site Complexity: The existing site will be intensively developed. Because of the construction and resulting graphic complexity, it is impractical to show every detail. However, the general design intent is clearly shown and shall be applied to individual conditions not specifically shown as directed by the Architect and at no additional cost to the Owner.

O. Asbestos, Toxic and Hazardous Materials: The Division 31, 32 and 33 site work contract does not include testing for, handling or removal of hazardous materials such as, but not limited to: asbestos, fuel, oil, PCB's, or other toxic or hazardous waste materials as identified by the EPA and/or NYSDEC. If any such materials are encountered during any part of the site work, the Contractor is responsible for identifying potential hazardous material and immediately notify all governing agencies having jurisdiction as required by law. Also, within one (1) hour of discovery notify the Architect, Landscape Architect, Consultants, and Owner. The Owner shall provide testing and removal by others, under separate contract. The Contractor shall recommence work under this contract when the Owner provides written certification that remediation is complete per governing agency. The Contractor shall not be penalized for any delays caused by the hazardous testing and removal unless such hazardous material incident was a result of Contractor's operations. The Contractor shall indemnify and hold harmless the Architect, Landscape Architect, Consultants and Owner, agents, and employees from and against all claims, damages, losses and expenses, direct and indirect or consequential damages, including but not limited to fees and charges of attorneys and court and arbitration costs, arising out of or resulting from the performance of the work by the Architect, Landscape Architect, Consultants and Owner, or claims against the Architect, Landscape Architect, Consultants and Owner arising from the work of others, related to hazardous waste.

The above indemnification provision extends to claims against the Architect, Landscape Architect, Consultants and Owner which arise out of, are related to, or are based upon, the dispersal, discharge, escape, release or saturation of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, or pollutant in or into the atmosphere, or on, onto, upon, in or into the surface or subsurface soil, water or water courses, objects, or any tangible or intangible matter, whether sudden or not.

Should the hazardous material incident be the result of the Contractor's operations, the Contractor shall be responsible for all costs associated with the discovery and remediation of such hazardous material such as, but not limited to: testing, consultant fees, damage, loss, fees and charges of attorneys, court and arbitration costs, claims by other contractors, direct and indirect or consequential damages.

P. Salvageable Items: Remove at any time after work starts. Storage or sale on site of salvageable and removed items is not permitted. Do not remove topsoil from site without written permission from the Owner.

Q. SUBMITTALS/PROCEDURES: Submit Tests, Shop Drawings, Material Certificates (showing content/mechanical analysis) and Manufacturer's Product Data (MPD) to Architect for review a minimum of two (2) weeks prior to installation.

1. Provide a minimum of five (5) copies from material producer or laboratory, stamped as checked and approved by the Contractor before submittal to the Architect or as otherwise indicated in Division 1. (Note: Electronic submittal process may be acceptable when approved by the Owner and Architect.)
2. Refer to individual specification sections for a list of required submittals.
3. For each material certificate required, provide certification by an Architect approved independent testing laboratory which gives analysis results and states that the material complies with or is superior to the specified requirements.

1.6. SUBMITTALS: (See 1.5, above)

A. Provide photographic documentation. Photographically document existing features which, may be affected by the construction, inside and outside the contract limit line. Existing features include, but are not limited to: structures, pavements, curbs, utilities, lawns and vegetation, especially individual trees which are over six (6") inches in diameter and noted to remain on the drawings. Also, particular attention shall be paid to the construction access, stockpile, and haul road areas. Distribute a copy of the photographic documentation (color prints or digital format) to the Owner and Architect prior to the start of construction.

PART 2. PRODUCTS

2.1. PLASTIC FENCE:

A. Shall be new or good quality used 4'-0" high heavy duty orange plastic fence NC450.

B. Posts shall be new or good quality U-channel posts to hold plastic fence.

2.2. OTHER PROTECTIVE DEVICES:

A. Shall include, but not be limited to; wood planks, rubber mats, barriers, lights, barricades, coverings, traffic controls, steel plates, and other temporary protections.
B. Contractor to provide all necessary protections required by Occupational Safety and Health Administration (OSHA) and Voorheesville CSD.

PART 3. EXECUTION

3.1. PROTECT EXISTING VEGETATION TO REMAIN:

A. Prior to commencing site preparation work, notify Architect, and meet on site to locate existing trees, lawns and vegetation which are to remain.

B. Protect and keep existing vegetation to remain free from physical damage. Keep in a healthy, vigorous growing condition for the entire construction period as follows:

1. Keep site disturbance and staging limits to a minimum. Obtain approval from Owner for material and equipment storage areas. Limit access points and routes to the project site. Coordinate site access with other trades and contractors on the work site.

2. Groups of Trees and Vegetation: Place orange plastic construction fencing around drip line(s) of trees and plant beds as detailed or directed by the Architect. Do not store materials, run equipment, park vehicles, or otherwise disturb area within the drip line (full canopy of tree) or in plant beds.

3. Specimen and Individual Trees: Protect each as noted and detailed. Do not store materials, run equipment, park vehicles or otherwise disturb area within the drip line (full canopy of tree).

C. Rejuvenate damaged vegetation by pruning watering, fertilizing, staking and other methods as directed by the Architect. Replace trees and other vegetation that cannot be restored to full growth with comparable size, quantity, quality and species as determined by the Architect.

D. Repair lawns disturbed due to construction operations outside the grading limits, as specified and directed by the Architect. Provide screened topsoil, seed, and mulch over damaged lawn areas, access ways or where tire rutting occurred.

3.2. TOPSOIL STRIPPING AND STOCKPILING ON SITE:

A. Strip full depth of existing topsoil from areas to be regraded, paved, or otherwise built upon. When amount of available topsoil exceeds what is indicated in geo-tech/boring report, on site test pits, or Contractor assumed depth, continue to remove all topsoil and lower the paved or built element subgrade. Place additional satisfactory earth fill in uniform depths as indicated in the Site Earthwork Section 312201. Maintain finished grades as shown on the drawings. This work shall be done at no additional cost to the Owner.

B. Minimum quantity of topsoil shall be as needed to provide four (4") inches settled depth on lawn areas. Verify quality and quantity. Supply imported topsoil when amount of available topsoil meeting above requirements is less than what is required for the proposed lawn areas. See Section 329201 for imported topsoil requirements.

C. When amount of available topsoil meeting above requirements exceeds what is required for the proposed lawn and athletic field areas, lower the lawn and athletic field subgrade and place additional topsoil in a uniform depth as directed by the Architect. Maintain finish grades as shown on the drawings. This work shall be performed and supplied at no additional cost to the Owner.

D. Topsoil shall be well drained, homogeneous texture soil of uniform grade, without the admixture of subsoil material. Topsoil shall be free of dense material,

hardpan, and stone over one-half (1/2") inch in diameter, and other objectionable foreign material including, but not limited to, brick, concrete, asphalt, glass, nails, screws, toxins, hazardous wastes and chemicals (such as, but not limited to, atrizene and muriatic acid) that may be injurious to humans, animals and plant materials.

E. Stockpile on site where shown on the drawings or as directed by the Owner. Provide all hauling as necessary. Do not mix topsoil stockpiles with other materials. Stabilize and maintain all stockpiles as specified. Excess topsoil, not needed for proposed lawns, as specified, shall be loaded and hauled offsite at no additional cost to the Owner.

3.3. SITE CLEARING AND REMOVALS:

A. Items and materials noted to be removed shall become the property of the Contractor, unless otherwise noted. Obtain Owner's approval prior to removal off site or for relocation of salvaged material on site. Remove material off site and legally dispose of it. Backfill voids with imported granular backfill, placed in eight (8") inch layers compacted to 95% maximum density.

B. Remove physical elements above and below grade as shown and which interfere with proposed construction. Physical elements include but are not limited to: trees, root systems, shrubs, vines, grass, vegetation, pavements, walks, curbs, gutters, foundations, previous construction materials, glass, headwalls, flared end sections, catch basins, manholes, inlets, drywells, septic tanks, unused utilities, pipes, cisterns, walls, rocks, and other debris.

C. Trees, shrubs and roots shall be completely removed and chipped into two (2") inch and smaller pieces and spread in existing wooded areas no deeper than four (4") inches settled depth. Spread as directed by the Owner and Architect.

D. Maintain existing utilities shown to remain and protect from damage during demolition and construction operations. Do not interrupt existing utilities; provide temporary services when required, as acceptable to the Architect.

E. Research with Owner possible locations of existing subsurface utilities prior to excavating.

3.4. ASPHALT MILLING:

A. The Contractor shall mill existing asphalt and dispose off site.

B. The Contractor shall use equipment with automatic grade and slope controls, capable of cold milling existing asphalt pavement to an accurate depth of cut, profile and cross slope and shall be capable of loading the milled material directly into trucks.

C. Cold milling asphalt pavement shall be performed in a manner which prevents the tearing and breaking of underlying and adjacent pavement and the contamination of the millings with granular subbase material, subgrade or deleterious materials. All millings shall be loaded directly to trucks from the milling machine and hauled to stockpile or disposed of.

D. The milled surface shall be swept and power washed clean prior to installation of new surface material. The Contractor shall sweep the surface in a manner which minimizes dust.

E. The Contractor shall promptly repair any and all localized areas of distress in the milled surface that may present a hazard to traffic, the stability of the new asphalt or deemed unsuitable by the Architect, at no additional cost to the Owner.

F. Contractor shall apply a NYSDOT approved tack coat to the cleaned, milled, and properly repaired and stabilized surface in preparation to received new top course asphalt as specified in Section 321201 - Asphalt Paving.

3.5. SAW CUTTING:

A. The Work consists of vertical saw cutting of the existing asphalt or concrete pavement structure to facilitate the removal of the asphalt or concrete bound material.

B. The equipment shall be capable of producing a smooth vertical saw cut without causing damage to the adjacent pavements.

C. The Contractor shall saw cut the asphalt/concrete pavement to a depth which will allow removal of the material without causing damage to the adjacent pavement. Rough, jagged, or cracked edges will not be acceptable. Concrete pavement shall be removed at the nearest contraction joint.

3.6. RELOCATIONS:

A. Any item noted to be relocated shall be removed by the Contractor from its existing position without damaging it, stored, protected from theft, fire, vandalism, and damage for the project duration. Reset in the location(s) and in the manner detailed, noted on the drawings, or specified.

B. Backfill voids with imported granular fill material, placed in eight (8") inch layers compacted to 95% maximum density when located in proposed pavement areas or 90% maximum density when located in proposed non-paved areas.

C. Salvaged items shall be returned to the Owner as noted on the drawings. Move items to Owner designated areas.

3.7. CLEAN UP:

During the contract and at intervals as directed by the Architect and as site preparation is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION

SECTION 312201 - SITE EARTHWORK

PART 1. GENERAL

1.1. DESCRIPTION OF WORK:

A. The extent of site earthwork and site grading is shown on the drawings.

B. Site earthwork includes, but is not limited to, the following:

1. Fill Materials
2. Source Quality Control
3. Shoring, Bracing and Supporting
4. Horizontal and Vertical Layout
5. Grading and Excavation
6. Compacted Backfill and Fill
7. Field Quality Control Testing and Inspection Services
8. As-Built Survey by NYS Licensed Surveyor
9. Guarantee
10. Clean Up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2. RELATED WORK SPECIFIED ELSEWHERE:

A. Section 311201 - Site Preparation

B. Section 312501 - Erosion, Sediment and Pollution Control

C. Section 334001 - Storm Drainage

1.3. REFERENCES:

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials

B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D 75 - Practice for Sampling Aggregates

D. ASTM D 422 - Particle-Size Analysis of Soils (without Hydrometer Analysis)

E. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)

F. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)

G. ASTM D 2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

K. ASTM D 6938 - In Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

L. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

M. ASTM D 5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

N. Occupational Health and Safety Administration Regulations and Standards

1.4. SUBMITTALS: (See Section 311201, 1.5)

A. Furnish name of New York State licensed Land Surveyor to be employed and perform project layout. Obtain Architect's approval prior to performing work.

B Submit written report on NYS licensed Land Surveyor's letterhead verifying that professional's involvement with the project layout. The report shall briefly state the scope of services performed for the project, the dates work was accomplished and an explanation of any adjustments required, specifically listing as-built and FIELD VERIFY requirements as noted in 3.2 of this specification section.

C. Provide Earthwork Contractor's experience requirements as indicated in 1.5, "Quality Assurance". Obtain Architect's approval prior to performing work.

D. Samples: 10 lb. samples of each type of fill; submit in airtight containers to testing laboratory.

E. Materials Sources: Submit name of imported materials source for each type of fill material.

F. Fill Composition Test Reports (Imported and Onsite): Provide results of laboratory tests (less than 2 months old) on proposed and actual materials used to determine acceptability. This shall include:

1. One optimum moisture-maximum density curve (Modified Proctor) for each soil/imported fill type as determined by ASTM D1557, Method A, latest issue.
2. Sieve Analysis - ASTM D422
3. Moisture Density Relationship - ASTM D1557, Method C / ASTM D698
4. Plasticity Index - ASTM D4318

5. Soundness Test - ASTM C88
6. Soil Classification - AASHTO and ASTM D2487

G. Compaction Density Test Report(s) required in Field Quality Control of this specification.

H. Contractor's NYS Licensed Professional Engineer's layout and design calculations of sheet piling and shoring required.

I. As-Built Survey: The Contractor shall have NYS Licensed Land Surveyor provide an updated AutoCAD file .dwg site survey, version 2020, or newer, and stamped pdf electronic copies of fully completed proposed site work (including but not limited to: spot elevations, contours, drainage structures and pipes with inverts, utilities, asphalt, concrete, stairs, ramps, and all site elements) at ALL proposed site work, to a minimum of 15'-0" beyond the proposed site work into existing conditions.

1.5. QUALITY ASSURANCE:

A. Perform all site earthwork, site grading and excavation in compliance with requirements of governing authorities having jurisdiction, OSHA Standards, and "References" in this project specification.

B. The Owner will employ a licensed soil testing and inspection service for Field Quality Control Testing of materials. This Contractor will coordinate day to day scheduling with the Owner's testing agency for conformance with "Field Quality Control Testing and Inspection Services" in this project specification.

C. Earthwork Contractor Experience Requirements: Submit business name, business Owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Earthwork for this Project. Provide a list of at least four (4) Earthwork projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.

D. Layout Foreman Experience: The Earthwork Contractor must provide a competent layout foreman skilled in this specific type of layout/earthwork project. The layout/earthwork foreman shall have a minimum of four (4) similar projects completed within the last three (3) years. Provide a list of projects layout/earthwork foremen has completed including project name, address, Owner contact information and project scope of work.

1.6. JOB CONDITIONS:

A. Job conditions in Section 311201 apply.

B. Provide sufficient quantities of fill materials to meet project schedule and requirements. When necessary, store materials on site in advance of need.

C. When fill materials need to be stored on site, locate stockpiles where directed by Owner.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination of material types.
3. Protect all stockpiles from erosion and deterioration of materials by covering with plastic sheets, tarps or as directed by the Architect.

D. Moisten or dry, fill or backfill materials, to the proper moisture content as determined in accordance with ASTM D1557, Method C in order to obtain proper compaction as indicated.

E. The Contractor shall familiarize him/her self with results and information contained within the Geotechnical Data & Attachment Report. These onsite soils are very sensitive to moisture and vibration. The Contractor shall take note and anticipate these soils will lose strength and mitigate in the presence of water and normal construction traffic and may turn into a "quick" condition (i.e. complete loss of shear strength and turning into a liquid-like condition). Achieving satisfactory compaction on these soils will be difficult, especially during wet conditions. This condition shall be taken into account within the Contractor's bid and schedule.

1.7. SUB-SURFACE SOIL INFORMATION:

A. Test borings and other exploratory operations may be made by the Contractor at no additional cost to the Owner, provided such operations are acceptable to the Architect and Owner. Coordinate test locations with Owner prior to starting work. Backfill immediately when completed and repair to satisfactory conditions as determined by the Architect. It is expressly understood that the Owner, Architect, Landscape Architect, and Consulting Engineers are not responsible for interpretations or conclusions drawn therefrom by the Contractor.

1.8. UNUSUAL SUBSURFACE CONDITIONS:

A. Notify the Architect immediately in writing via email when unusual conditions are encountered during excavation, including, but not limited to: excessive flooding, miscellaneous structures, uncharted or unlocated utilities, foundations, bed rock, toxic and hazardous materials and chemicals (such as muriatic acid and atrizene), suspected archaeological artifacts, and unsatisfactory soil materials. Request clarification from the Owner's Representative or Architect before proceeding. Refer to paragraph 3.4 of this specification.

PART 2. PRODUCTS

2.1. FILL MATERIALS:

A. **Satisfactory General Earth Fill:**

1. To be used at least 5'-0" outside of structural elements.
2. Satisfactory general earth fill shall be satisfactory on-site subsoil, or hauled in off-site subsoil free of toxics, hazardous wastes and chemicals (such as, but not limited to, atrizene and muriatic acid) that may be injurious to

humans, animals and plant materials. Satisfactory earth fill shall also be free of rubbish, debris, wood, masonry, metal, frost, vegetation, organics or other deleterious material, which cannot be properly compacted. Use satisfactory general earth fill that is dry and free of clay. Rocks, gravel or soil shall not be larger than 3" in any dimension/direction.

3. Satisfactory earth fill materials are also defined as those complying with the American Association of State Highway Transportation Officials (AASHTO), M-145 soil classification Groups A-1, A-2-4, A-2-5, A-3 and Unified Soil Classification System GW, GP, GM, GC, SW, SP, SM, and SC (or a combination of these group symbols) as determined by ASTM D2487.

B. **Imported Granular Backfill and Granular Base Course:**

1. Imported granular backfill to be used for asphalt pavement subbase, concrete subbase, storm structures, storm pipes, water pipes, sanitary manholes, sanitary pipes, other structures, and where indicated on the drawings.
2. Backfill shall be run of crusher limestone meeting the following gradation as determined by ASTM-C136:

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
3/4" or 19 mm	75 - 90%
1/4" or 6.3 mm	25 - 60%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 8%

3. Backfill shall be free of debris and deleterious materials. In no case shall the plasticity index exceed 5.0 or the percentage passing the 200 mesh sieve exceed 8%. The quality of the imported granular backfill shall be determined by the magnesium sulfate soundness test, if considered suspect by the Architect or Geotechnical Engineer. The maximum percent loss at four cycles by weight shall be 20.

C. **Imported Structural Fill:**

1. Imported structural fill to be used in areas of structural elements and where noted on the drawings.
2. Shall be run-of-crusher gravel free from organic matter or other deleterious materials, meeting the material gradation requirements of Item 304.05 Sub-base Course, Type 4, of the NYSDOT's Standard Specifications for Construction Materials, as determined by ASTM C136.

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
1/4" or 6.3 mm	25 - 60%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 8%

3. Imported structural fill shall be accepted on the basis of gradation, soundness, plasticity index and a well-defined Moisture-Density Relationship Curve. Imported structural fill to be placed within 8" of final exterior subgrade shall be subject to Soundness requirements. Soundness shall be less than 30% loss based on a four-cycle magnesium sulfate soundness test. Plasticity Index of that portion of fill material passing the No. 40 mesh sieve shall not exceed 5.0.

D. **Stormwater Management Trench (SMT) Backfill:**

1. Shall be No. 1 clean, washed, crushed stone meeting the following gradation as determined by ASTM C136:

Standard Sieve Size	Percent Passing By Weight
1" or 25.0 mm	100%
1/2" or 12.5 mm	90-100%
1/4" or 6.3 mm	0-15%

2.2. UNSATISFACTORY SOIL MATERIALS:

A. Shall be defined as soil with high percentage of decomposed rock, sand, organic matter or moisture laden clay to prevent adequate compaction. Also, soil with toxics, hazardous wastes and chemicals (such as atrizene and muriatic acid) that may be injurious to humans, animals and plant materials. Also, soil with significant quantities of rubbish, debris, wood, masonry, metal, frost or other deleterious material which, in the opinion of the Geotechnical Engineer, Owner's Representative, and Architect, cannot be properly compacted shall be classified as unsatisfactory.

B. Unsatisfactory soil materials are defined as those described in AASHTO M-145, soil classification, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 with CBR value less than 7.0. Also Unified Soil Classification System ML, CL, OL, MH, CH, OH as determined by ASTM D2487 (or a combination of these group symbols) with CBR value less than 7.0 in addition to peat (PT) and other highly organic soils, cobbles, boulders; and soil materials, of any classifications that have a moisture content at the time of compaction beyond the range of 1% below and 3% above the optimum moisture content of the soil material/backfill material, as determined by the Moisture Density Relationship test.

C. When unsatisfactory soil materials are encountered at proposed subgrades and other design elevations, proceed as described in Part 3 (Execution) of this Section.

D. When excavated materials become unsatisfactory as a direct result of the Contractor's work, this shall result in the rejection of the unsatisfactory soil materials by the Architect.

E. The use of slag (a byproduct of metal processing) or recycled/crushed concrete is unacceptable for any use on this project site.

2.3. SOURCE QUALITY CONTROL:

A. See "Submittals" and "Quality Assurance" of this specification section for general requirements for testing and analysis of soil and fill materials.

B. Where fill materials are specified by reference to a specific standard, Contractor is responsible to test and analyze all samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest until approved.

2.4. SHORING, BRACING AND SUPPORTING:

A. Shoring and bracing shall conform to the requirements of the Occupational Health and Safety Act.

B. Shoring and bracing shall be provided, placed, and maintained at the locations and elevation that are necessary or required to: support and protect the sides and bottom of the excavation; prevent undue disturbance or weakening of the supporting materials below or beside the works; prevent movement of ground which may disturb or damage the work, adjacent pavements, property, structures or other works.

C. Provide materials for shoring, bracing and supporting, such as sheet piling, uprights, sheathing, stringers and cross-braces, in good serviceable condition. Use timbers that are sound and free of large or loose knots.

D. Provide design by Contractor's NYS Licensed Engineer, when shoring is required to perform work as shown on the drawings. Submit to Architect for approval.

E. Installation: Shoring and bracing shall be driven and placed so that it can be removed as backfilling takes place without damage to the pipeline or its appurtenances, structures, and without settlement of or damage to adjacent pavements and structures.

F. Removal: The Contractor shall remove all shoring and bracing as the excavation is backfilled, unless directed by the Architect to be left in place. The procedure for extracting shoring and bracing and placing backfill shall ensure the backfill load is applied gradually, and disturbance of the works or foundation material is avoided.

G. Support all utilities as required by the municipality/utility owner.

PART 3. EXECUTION

3.1. EXAMINATION:

A. Verify field conditions such as benchmarks, monuments, topography, inverts, locations of utilities and property lines before proceeding. Notify the Architect immediately, in writing, of discrepancies prior to commencing work.

Commencement of work will be construed as complete acceptance of survey and layout information. Additional costs resulting from failure to verify field conditions prior to commencing work shall be borne by this Contractor and at no additional cost to the Owner.

3.2. LAYOUT:

A. Stake layout up to and including those elevations and dimensions specifically noted on drawings as "FIELD VERIFY" (FV). Ensure that the field elevation and dimension agree with the elevation and dimension on the drawings before continuing. Notify the Architect immediately, in writing, of any discrepancies prior to commencing work. Additional costs resulting from failure to verify dimensions as noted on drawings shall be borne by this Contractor and at no additional cost to the Owner.

1. Assume sole responsibility for the accuracy of the layout work.
2. Run from point(s) of beginning (POB), base lines, property monuments, benchmarks, iron survey pins, or other points given on the drawings.
3. Roads, Parking Areas, and Walks: Accurately locate and stake curb lines, center line, swales, point of curve and tangency as necessary to accurately build.
4. Buildings and Site Features: Accurately locate and stake corners, offset corners, slopes, and center lines as necessary to accurately build.
5. Pipe Work: Accurately locate with laser.

3.3. GRADING:

A. Cut and Fill: Presume the earthwork does **NOT** balance on site. Meet the grades shown on the drawings. Haul in or haul away as may be necessary. Provide earthwork calculations and provide imported or exported material as part of bid. No additional costs will be allowed.

B. Grade areas as indicated, including transition areas, with uniform levels and slopes between finish elevations.

C. Cut to grades and profiles indicated.

D. Set grade stakes at fifty-foot (50') intervals, at corners, and breaks in grade.

E. Conduct operations to avoid ponding water. Provide all pumping equipment, sump pits, and temporary diversion swales where and when necessary to continue work performance on schedule and as specified.

F. Shape subgrade surface of site elements to within 0.10' above or below required subgrade elevation, compacted as required and sloped to provide drainage as shown on the drawings. Notify Architect and Geo-Technical Engineer for subgrade review prior to continuing work.

G. Refer to Section 311201 for topsoil requirements.

3.4. EXCAVATION:

A. Remove and legally dispose of material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed.

B. Sloping and Benching: Follow OSHA recommendations based on soil type to determine slope configurations. Slope the sides of excavations five (5') feet deep and over to the angle of repose of the material excavated; otherwise, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.

C. Bracing and Shoring:

1. Provide bracing and shoring as required in excavations, to maintain sides and to protect structures from settlement.
2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.
3. Remove shoring and bracing before completion of backfilling except where required for structural support or slope stability.
4. The design, installation, and maintenance of such shoring and bracing required to accomplish the above purpose are the sole responsibility of the Contractor.
5. Follow OSHA recommendations for bracing and shoring.
6. Indemnify the Owner, the Landscape Architect, Architect, and the Consulting Engineers against any action arising from damage to existing structures, utilities or injury to persons resulting from the Contractor's actions or failure to act, in carrying out the intent of this section.

D. Protections: Protect structures, vegetation, utilities, sidewalks, pavements, and other facilities in areas of work. Barricade and secure open excavations and provide warning lights/signage from dusk to dawn each day.

E. Extent of Excavations: Excavate for structures to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of other work and for review. Trim bottom to required lines and grades to provide solid base to receive concrete or imported granular backfill material.

F. Unsatisfactory Soil Materials: When unsatisfactory soil materials, as defined in this specification, are encountered at design elevations, immediately notify the Architect in writing by email or other equally expeditious means. Continue as directed by the Architect and Geo-Technical Engineer. When, in the sole opinion of the Architect, conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price or negotiated price basis in accordance with Contract Documents. This additional excavation shall be measured each day and verified by the Owner's representative and the Contractor's Superintendent. A daily written accounting, attested by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. Assume **500 c.y.** of undercutting and removals, placement of soil stabilization fabric (SSF) and providing and

compacting to 95% density imported granular backfill material in Base Bid. Unit price provided shall be utilized to add to or delete from this assumed quantity to account for actual quantity encountered.

G. Unauthorized and Over Excavation: Consists of removal of materials beyond required subgrade elevations or dimensions without specific direction of the Architect or Geotechnical Engineer. Unauthorized or over excavation, as well as remedial work directed by the Architect or Geotechnical Engineer, shall be at Contractor's expense. Fill of unauthorized excavations shall be as follows (all at no additional cost to the Owner):

1. Fill the voids created by the removal of materials beyond indicated subgrade elevations with lean concrete (2000 psi). Or;
2. Extending the indicated bottom elevation of the concrete footing to the lower elevation. Or;
3. Adding imported granular backfill material compacted to 95% density to proper design elevation and layout as directed by the Architect. Testing agency to perform compaction testing prior to proceeding.

H. Dewatering:

1. Contractor shall anticipate seasonal variations of soil moisture content and groundwater in the Base Bid as verified by site investigation indicated in Section 311201.
2. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

    a. Surface and ground water shall be intercepted and removed before entering excavations. All necessary measures shall be taken. Earth dikes, ditches, or other devices, if required, shall be constructed to prevent such flows.

3. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

    a. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
    b. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
    c. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

4. The Contractor shall at all times provide and maintain proper and satisfactory means and devices (i.e. ditches, temporary pipes, pumps, and/or other temporary construction) for the removal of all water entering the excavations. Water shall be removed as fast as it may collect, in such manner that shall not interfere with the execution of the work or in the proper placing of pipe, structures or other work.

5. Provide and operate sufficient pumping machinery to keep excavated parts free of water. Dig sump pits when necessary into which the excavation shall be drained. Take care and proper precautions in the use of pumps so that in no case will foundations, footings and utilities already in place or existing foundations, footings of adjacent structures or utilities be undermined or disturbed and erosion occur due to pumping.
6. Do not discharge pumped materials into any body of water, wetland, adjacent property, road side swales, subsurface storm systems, or any infiltration practices as determined by the Architect. Provide temporary sediment basins, traps, and filter bags for pumped water.
7. Adjust, repair, replace, or clean all work, surfaces, and property, which may have been affected as a result of any dewatering operation.

I. Prepare subgrade and twelve (12") inches of existing sub-soils below subgrade elevations in excavated areas to minimum density of 95% in structure, pavement, utility areas, trenches, and 90% under lawn non-paved areas.

J. Rock and Rock Excavation:

1. Rock Definition: Shall be defined as solid hard material located in ledges, bedded aggregate deposits and unstratified masses, and all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, which must be removed by pneumatic hammers. Rock does not include shale, slate, soft sandstone, hardpan, masonry or concrete rubble, boulders less than three (3) cubic yards, such other rock material which is decomposed, stratified, weathered or shattered, or any material capable of being removed by a well maintained Caterpillar 225 power shovel, D8 Dozer with Ripper, or Architect approved equivalent.
2. Rock Excavation Administrative Procedures: When encountered, shall be stockpiled for measurement before removal and paid for on a unit price basis in accordance with Contract Documents. Notify Architect immediately of rock discovery prior to performing any rock removal or continued excavation. Rock excavations as defined shall be measured each day and verified by the Owner's designated representative and the Contractor's on-site Superintendent. A daily written accounting, attested to by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. Contractor to assume **50 c.y.** of rock excavation and removal in Base Bid. Unit price provided shall be utilized to add to or deduct from this assumed quantity to account for actual quantity encountered.
3. Rock Excavation Removal Procedures: Includes removal and disposal of rock. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions.

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 8 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

4. Any over excavation due to rock excavation and removal shall be handled as directed under "Over Excavation" in this Section.
5. Contractor has the option to remove existing rock and dispose off-site or crush existing rock and use as satisfactory general earth fill when it meets gradation noted in 312201 for imported granular backfill material.

3.5. BACKFILL AND FILL:

A. Preparation of Ground Surface to Receive Fill: Remove vegetation, organic materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Break up and remove existing foundations, concrete slabs, abandoned utilities, and site features. Plow, strip, roughen, or break up slopes steeper than 1 vertical to 4 horizontal so that fill material will bond to existing surface.

B. Execute these steps when the existing ground surface, after removal of the above unsatisfactory soil materials, has a density less than that specified under "Compaction" for the particular area classification: Break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to the required depth and percentage of maximum density.

C In no case shall fill be placed on a subgrade that is wet, muddy, rutted, spongy, frozen or that contains frost or that has not been tested and approved to achieve satisfactory results.

D. Areas to receive any fill or backfill should be properly prepared, proof rolled, tested per "Field Quality Control" within this specification, inspected and approved by the Architect and Geo-Technical Engineer prior to the placement of fill.

E. Following grade approval by the Architect and Geo-Technical Engineer, place imported granular backfill, imported structural fill and satisfactory general earth fill material in layers not more than eight (8") inches in loose depth in a manner to minimize segregation. The fill shall be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift.

F. Moisture Content: Contractor shall anticipate seasonal variations of all soils (on site or imported) and imported fills moisture content in the Base Bid and timing required for such shall be included in the project schedule. The moisture content of the materials shall be adjusted prior to application of compaction such that it is no more than 1% below or 3% above the optimum moisture content of the material. Apply water to surface, subgrade or layers of soil material when required to achieve compaction densities stated below. Remove and replace, or scarify and air dry, soils or imported materials that is too wet to permit compaction to specified density.

G. Compaction:

1. Compact each eight (8") inch layer of fill and backfill materials.
2. Compact fill and backfill material below subgrade for structures, slabs, pavements, and utilities to minimum 95% of optimum in place density as determined by ASTM D1557, Modified Proctor.
3. Compact fill material below subgrade for lawns or unpaved areas to minimum 90% of optimum in place density as determined by ASTM D1557, Modified Proctor.

H. Equipment:

1. Use sheepsfoot rollers, pneumatic tired rollers, drum rollers, vibrating tampers, and other compaction equipment capable of obtaining the required density throughout the entire layer being compacted.
2. Use power-driven hand tampers for compacting materials adjacent to site structures.
3. For utility trenches or other confined areas, small compaction equipment may be necessary such as a vibratory plate, jumping jack or walk-behind vibratory roller. In these cases, lift heights no greater than six (6") inches should be maintained.

I. Reconditioning Compacted Areas: Where previously completed compacted areas are disturbed by subsequent construction operations (by any Contractor), traffic or adverse weather, scarify and dry out the surface, regrade, and recompact to the required density prior to further construction at no additional cost to the Owner. Use hand tamping for recompaction over underground utilities and trenches.

3.6. FIELD QUALITY CONTROL TESTING AND INSPECTION SERVICES:

A. Soil Testing Service/Geo-Technical Engineer must inspect and approve density tests, retesting, and proof rolling of subgrades, as described in this section, before further construction work is performed thereon.

B. Perform compaction density testing on compacted fill and imported granular base course in accordance with ASTM D1556, ASTM D1557, ASTM D2922, and D3017.

C. In place density testing should be performed at a frequency of one (1) test per 500 square feet per lift in smaller open areas, one (1) test per 2,500 square feet per lift in larger open areas, and one (1) test per 25 feet per lift in confined areas and utility trenches.

D. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take action to modify or alter the moisture content in the soil, to provide additional compaction and testing or otherwise to increase the in-place soil density. If the Contractor cannot obtain satisfactory compaction due to material properties, the Contractor shall remove the unsatisfactory material and replace with new material at no additional cost to the Owner.

E. Materials contaminated by mud, debris, organics, frost, and/or other deleterious materials shall be removed and replaced with uncontaminated specified material.

F. No fill or backfill shall be placed over an area or lift of fill that has not be tested and achieved satisfactory results.

G. Proof Rolling: On pavement subgrades, in cut areas only, unless otherwise directed by the Architect, the only testing required will be the proof rolling as described below:

1. Provide Soil Testing Service/Geo-Technical Engineer with 48 hour advance notification when subgrades are ready to proof roll.
2. Proof Roll the prepared pavement subgrade surface with fully loaded ten (10 c.y.) cubic yard earth moving truck or, in the opinion of the Architect/Geo-Technical Engineer, using a 5-ton smooth drum roller making at least 3 overlapping passes, in each of 2 perpendicular directions, on static mode at a speed of 1 to 4 feet/second. Check for unstable areas. Subgrades that rut, pump or deflect under the truck's tires may be judged unstable by the Architect/Geo-Technical Engineer. These areas may require further compaction or undercutting as directed by the Soil Testing Service/Geo-Technical Engineer.

3.7. AS-BUILT SURVEY

A. Provide full as-built survey in AutoCAD .dwg format with stamped .pdf electronic files to the Architect for approvals. Survey shall include: spot elevations, contours, drainage pipes and structures with installed inverts, utilities, and all site pavements and elements)

B. Survey shall be conducted by a NYS Licensed Surveyor.

C. Areas to be surveyed include ALL completed proposed site work to a minimum of 15'-0" beyond the proposed site work into existing conditions.

3.8. GUARANTEE:

A. Guarantee pavements, pads, ramps, trenches, utilities, structures, and lawns free from settlement for a period of one (1) year from the date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Architect, whichever is later.

B. Repair to proper grade and alignment any and all settlement of pavements, pads, trenches, utilities, structures, plant materials, and lawns adversely affected by settlement within one (1) year after date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Architect, whichever is later, at no additional expense to the Owner. In damaged compacted areas, scarify the surface, re-shape, and compact to required density prior to further construction.

C. All repairs/corrections shall be completed to the satisfaction of the Owner within seven (7) days of written notice by the Owner.

3.10. CLEAN UP:

During the contract and at intervals as directed by the Architect and as earthwork is completed, clear the site of surplus earth, large surface stones, debris, tools and equipment. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION

PART 1. GENERAL

1.1. DESCRIPTION OF WORK:

A. Provide erosion, sediment and pollution controls as shown on the drawings and as directed by the Architect to significantly reduce runoff on downstream and neighboring properties. This includes temporary control measures to mitigate land disruption by other Contractors during construction of this project.

B. Erosion, sediment, and pollution control includes, but is not limited to, the following:

1. Storm structure protection
2. Silt fence
3. Rip rap (cobbles)
4. Temporary seeding and mulching
5. Permanent seeding
6. Construction site dust control
7. Spill prevention, reporting, and documentation
8. Clean up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2. RELATED WORK SPECIFIED ELSEWHERE:

A. Section 311201 - Site Preparation

B. Section 312201 - Site Earthwork

C. Section 329201 – Sodded Lawns

D. Section 334001 - Storm Drainage

1.3. REFERENCES:

A. Spill Guidelines Manual (SGM) New York State Dept. of Environmental Conservation.

B. New York State Standards and Specifications for Erosion and Sediment Control, dated July 2016 or latest edition.

1.4. SUBMITTALS: (See Section 311201, 1.5)

A. Manufacturer's Data (MPD) are required for:

1. Filter Fabric for Storm Structure Protection
2. Silt Fence with Net Backing
3. Spill Response Equipment

B. Material Certificates (MC) showing content/mechanical analysis and Samples are required for:

1. Rip Rap (cobbles)
2. Temporary Seeding and Mulching: Submit seed mix species and mulch source
3. Permanent Seeding: (See Section 329201)

C. Listing of emergency contract numbers. This list shall include the name of an Emergency Response Contractor that may be used in certain situations.

1.5. QUALITY ASSURANCE:

A. Perform erosion, sediment, and pollution control in compliance with applicable requirements of the New York Standards and Specifications Erosion and Sediment Control Manual, dated July 2016 (or latest edition) or other governing authorities having jurisdiction.

B. It is this Contractor's responsibility to prevent stormwater pollution from running offsite. All pollution control work related to the site contract shall be included in the Base Bid. All pollution control work related to other contracts shall be on a time and material basis and back-charged to the responsible party.

C. In the event of a chemical or hazardous spill or release, the individual(s) who caused the spill is responsible for prompt and proper clean-up. If the spill requires cleanup procedures beyond the means of the Contractor, an emergency spill cleanup Subcontractor shall be hired by the Contractor. They shall be utilized when the Contractor does not have the appropriate training, equipment or materials to cleanup the area safely and effectively. This shall be done at no additional cost to the Owner. Any testing and cleanup required post cleanup shall be provided by the Contractor at no additional cost to the Owner.

1.6 JOB CONDITIONS:

A. Job conditions in Sections 311201, 312201, 329201 and 334001 apply.

B. Contractor will take all necessary precautions to avoid allowing dust generation that violates NYSDEC regulations and compromises compliance with governing authorities air monitoring plan.

1.7 INSPECTIONS AND MAINTENANCE:

A. The Architect or qualified personnel of the Operator shall inspect disturbed areas of the construction site at least once per week. Special attention will be focused on areas not finally stabilized, structural control measures, point discharge (outlets) and locations where vehicles enter or exit the site. Disturbed areas will be inspected for pollutants entering the drainage system. Structural control measures will be reviewed for effectiveness in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site will be inspected for evidence of off site sediment tracking.

B. The Contractor shall provide timely maintenance of vegetation erosion and sediment control measures, and other protective measures, during construction. Corrective measures must be performed within one (1) calendar day of the Architect's or Operator's (Owner's) report. Failure by the Contractor to perform

corrective work within this schedule automatically authorizes the Operator to hire others and backcharge this Contractor. The Architect or Operator will send a letter or email correspondence one (1) calendar day before hiring others and backcharging this Contractor.

C. The Contractor shall conduct daily inspections of the equipment staging and maintenance, fueling, hazardous waste staging and waste storage areas to ensure that spill control measures are in place. Stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored on site.

D. The Operator (Owner) shall provide long term maintenance of the storm water facilities after the site is finally stabilized.

1.8 SPILL PREVENTION, REPORTING AND DOCUMENTATION:

A. To minimize the potential for discharge to the environment of oils, petroleum, or other hazardous substances, the following requirements shall apply:

1. All oil, petroleum, or hazardous materials stored or temporarily relocated on site during the construction process shall be stored in a way to provide protection from vehicular damage and to provide containment of leaks or spills. Temporary berms, dikes, storage basins, or similar methods shall be employed as appropriate on site.
2. Maintain file of Material Safety Data Sheets (MSDSs) or other references for recommended spill clean-up methods and materials.
3. Keep spill response equipment readily accessible.

B. In the event of a spill contact the Construction Manager, Owner (Operator), and Architect. The Contractor shall also notify all other Contractors working around the area of the spill.

C. If spilled material has entered any sanitary/storm sewer system then contact the municipality or agency with jurisdiction over the system, in addition to those listed in this section.

D. The contractor shall be responsible for the initiation of spill reporting and documentation procedures. All petroleum spills must be reported to NYSDEC Spill Hotline at 1-800-457-7362, less than two (2) hours following discovery. All petroleum spills must be reported to NYSDEC unless all of the following apply:

Criteria	Description
Quantity	Must be known to be less than 5 gallons.
Containment	Must be contained on an impervious surface or within an impervious structure. No access to the environment.
Control	Must be under control and not reach a drain or leave the impervious surface.
Cleanup	Must be cleaned-up within two (2) hours of occurrence.
Environment	Must not have already entered into soil or groundwater or onto surface water.

E. A release of a "reportable quantity"[1] or unknown amount of a hazardous substance must also be immediately reported to the NYSDEC Spill Hotline. Spills of reportable quantities of chemicals or "harmful quantities"[2] of oil to navigable waters must be reported to the federal National Response Center, 1-800-424-8802 or 1-202-426-2675.

[1] *Reportable Quantity*: Refers to the quantity of a hazardous substance or oil that triggers reporting requirements under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) (USEPA, September 1992).

[2] *Harmful Quantity*: Includes discharges that violate applicable water quality standards, cause a film, sheen, or discoloration on a water surface or adjoining shoreline; or cause a sludge or emulsion to be deposited beneath the water surface or shoreline (40 CFR 110.3).

PART 2. PRODUCTS

2.1. STORM STRUCTURE PROTECTION:

A. Shall be commercially manufactured, needle-punched, non- woven geotextile, comprised of polypropylene fibers. Standard of quality shall be Mirafi 140N as manufactured by Tencate/Mirafi Group, www.tencate.com, or Architect approved equal.

B. Stakes: Shall be square, non pressure treated hardwood. Size as detailed.

OR

C. 1A stone meeting the following requirements:

Standard Sieve Size	Percent Passing by Weight
1/2"	100
1/4"	90-100
1/8"	0-15
No. 200 Sieve	0-10

D. Contractor shall install on all storm structures in the project area as directed by the Architect.

2.2. SILT FENCE:

A. Shall be a woven polypropylene geotextile comprised of UV stabilized polypropylene slit film and 1.25" square, non pressure treated, pointed, hardwood posts and net mesh backing for additional support. Standard of quality for silt fence shall be IVI-3611MW as manufactured by Indian Valley Industries, Inc., www.iviindustries.com, (607) 729-5111, or Architect approved equal.

B. Contractor shall provide 250 linear feet of silt fence to be installed in a location as directed by the Architect.

2.3. RIP RAP:

A. Light: Shall be placed rip rap. Cobble stones conforming to NYSDOT Table 733-21A and the following gradations:

Standard Sieve Size	Percent Passing by Weight
Lighter than 100 lbs	90 - 100
Larger than 6"	50 - 100
Smaller than ½"	0 - 10

B. Gradation of rip rap shall be accepted or rejected based on a visual examination by the Architect prior to placing rip rap.

C. Soil Separation Fabric: Shall commercially manufactured non-woven polypropylene filter fabric. Standard of quality shall be Mirafi 140N as manufactured by NICOLON/MIRAFI GROUP or Architect approved equal.

2.4. TEMPORARY SEEDING AND MULCHING:

A. Seeding shall be 100% Perennial Ryegrass with no more than 30% of any one cultivar and always at least 2 different cultivars and a 90% germination rate or more.

B. All seed mixtures to contain 0.5% weed seed or less.

C. All seed must be fresh seed, not seed that is left over from last year and beyond the sell by date.

D. Mulch shall be clean straw.

2.5. PERMANENT SEEDING:

Seeding and mulching shall be as specified in Section 329201.

2.6. SPILL RESPONSE EQUIPMENT:

A. The following is a list of recommended spill control material. The contractor is responsible to have spill control and personnel protective equipment readily available for the materials being used. Acquire sufficient quantities and types of appropriate spill control materials needed to contain any spills that can be reasonably anticipated. The need for equipment to disperse, collect and contain spill control materials should be on site at all times.

1. Personal Protective Equipment
   a. Chemical Splash Goggles
   b. Gloves
   c. Boot Covers
   d. Tyvek Aprons or Suits

2. Absorption Materials
   a. Spill Pillows and Socks

b. Absorbent Booms and Pads
c. Dikes for use on rough surfaces
d. Storm Structure Covers
e. "Loose" Absorbents

3. Tools
   a. Shovel, Broom, Brush
   b. Disposal Bags
   c. Sealing Tape
   d. Hazardous Waste Stickers
   e. "Danger" and "Keep Away" Signs
   f. Five gallon pails or 20 gallon drums with polyethylene liners

B. Basis of Design shall be provided by: 3M, 888-364-3577; New Pig Corporation, 800-468-4647; SpillKits911, 800-474-5911; Dawg, Inc., 800-935-3294; or Architect approved equal.

C. Place spill response equipment in a readily assessable location within or immediately adjacent to the project site.

PART 3. EXECUTION

3.1. REQUIREMENTS:

A. Between the Pre-Construction Meeting and starting site work, the Contractor shall:

1. Review inspection and maintenance procedures.
2. Designate specific Owner and Contractor personnel responsible for daily inspection and maintenance.

3.2. GENERAL EROSION CONTROL:

A. Install initial construction erosion control features, as indicated on drawings and specifications or as directed by the Architect, prior to topsoil stripping, earthwork, and removal of existing vegetation. Keep the disturbance to a minimum and shall not exceed one (1) acre, unless directed by the Architect. Install other features as described in the sequence of erosion, sediment and pollution control on the drawings.

B. Start permanent seeding and mulching within seven (7) calendar days of rough grading. When this is not possible, provide temporary seeding and mulching of 100% perennial rye grass at the rate of six pounds (6#) seed per one thousand (1,000 sf) square feet and mulching. Provide temporary seeding and mulching within seven (7) days on non-roof, non-paved areas. When adverse weather conditions prevent good germination, repeat seeding as directed by the Architect until the area is stabilized. Till under temporary grass and fine grade when preparing for final permanent lawn stabilization.

C. Until a disturbed area is stabilized, trap runoff sediment by the use of sediment debris basins, diversion swales, sediment traps, or other methods acceptable to

the Architect and governing authorities. Provide temporary dry mulch (straw) to stabilize exposed soils as directed by the Architect.

D. Provide erosion controls on slopes and swales traversing, bordering, or leaving the site. Limit the water flow to a nonerosive velocity.

E. Do not store fill materials within one hundred (100) feet of the banks of any streams or waterbodies, intermittent or perennial.

F. Inspect erosion and sediment control measures immediately after each rainfall and at least daily during prolonged rainfall. Make required repairs immediately.

G. Remove sediment deposits when they reach approximately one-half of the height of the barrier. Dispose sediment in a manner that does not result in additional erosion or pollution.

H. Provide prompt (weekly) removal and disposal of rubbish and debris in accordance with the governing authorities, Owner policies, and good housekeeping measures.

3.3. MUNICIPAL SEWER, SWALES, CULVERTS, AND WETLAND EROSION CONTROL:

Control erosion, siltation and pollution to municipal sewers, swales, culverts, and wetlands by taking appropriate measures such as, but not limited to, the following:

A. Do not disturb the bed and banks of waterbodies unless specifically shown on drawings. When bed and bank work is shown, obtain permits and proceed with work creating the minimum disturbance necessary to complete the project.

B. Prevent petroleum products and excessive amounts of silt, clay, and muck from entering municipal sewers, waters, swales, culverts, or wetlands of New York State during construction.

C. Prevent fresh concrete, concrete leachate, and washings from equipment and trucks, from entering municipal sewers, waters, swales, culverts, or wetlands of New York State during construction.

D. Place silt fence to control erosion at the downslope edge of disturbed areas. This barrier to sediments is to be put in place before disturbance of the ground occurs and is to be maintained in good condition until disturbed land is heavily vegetated or otherwise permanently stabilized.

E. Seed and mulch areas of soil disturbance resulting from this project with appropriate perennial grass seed and mulched with straw within seven (7) calendar days as described in general erosion control. Mulch shall be maintained until a suitable vegetative ground cover is established and as directed by the Architect.

3.4. CONSTRUCTION SITE DUST CONTROL:

A. The Contractor shall prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety issues.

B. Dust control applies to construction roads, access points, other disturbed areas and stockpiles subject to surface dust movement and dust blowing.

C. Contractor may use any number and combination of dust control methods, as approved by the Architect. They include:

1. Applying water to haul roads
2. Restricting vehicle speeds to 10 mph
3. Hauling materials in properly tarpped or watertight containers.
4. Covering stockpiles and materials
5. Wetting equipment and work area
6. Mulching
7. Spray adhesives and polymer additives (MSDS sheets required)
8. Barriers and wind breaks

D. Contractor is responsible for any cleanup and site restoration associated with dust control measures, dust pollution on or off the project site property at no additional cost to the Owner.

3.5. STORM STRUCTURE PROTECTION (IN LAWN AREAS):

A. Cut fabric from a continuous roll to eliminate joints. If joints are needed they will be overlapped to the next stake.

B. Space stakes evenly around inlet 3 feet apart and drive a minimum 18 inches deep. Spans greater than 3 feet may be bridged with the use of wire mesh behind the filter fabric for support.

C. Fabric shall be embedded 1 foot minimum below ground and backfilled. It shall be securely fastened to the stakes and frame.

D. A 2" x 4" wood frame shall be completed around the crest of the fabric for over flow stability.

E. Wrapping the storm structure grate with fabric is NOT acceptable, however straw bales may be used in lieu of filter fabric.

3.6. STORM STRUCTURE PROTECTION (IN DISTURBED PAVED AREAS):

A. Recess the first course of blocks at least 2 inches below the crest opening of the storm drain for lateral support. Subsequent courses can be supported laterally if needed by placing a 2x4 inch wood stud through the block opening perpendicular to the course. The bottom row should have a few blocks oriented so flow can drain through the block to stone in place.

B. The stone should be placed just below the top of the blocks on slopes of 2:1 or flatter. Place hardware cloth over all block openings to hold stone in place.

C. As an optional design, the concrete blocks may be omitted and the entire structure constructed of stone, ringing the outlet ("doughnut"). The stone should be kept at a 3:1 slope toward the inlet to keep it from being washed into the inlet.

D. A level area 1 foot wide and four inches below the crest will further prevent wash. Stone on the slope toward the inlet should be at least 3 inches in size for stability and 1 inch or smaller away from the inlet to control flow rate. The elevation of the top of the stone crest must be maintained 6 inches lower than the ground elevation down slope from the inlet to ensure that all storm flows pass over the stone into the storm drain and not past the structure. Temporary diking should be guised as necessary to prevent bypass flow.

3.7. SILT FENCE:

A. Locate as shown on drawings and as directed by the Architect. Excavate trench along the lower perimeter(s) of site, along the contract limit line, and as indicated on the drawings. Place excavated material on uphill side of trench for backfilling.

B. Drive stakes securely into the downhill side of the trench. When prefabricated silt fence with fabric attached to stakes is used, drive stakes so that fabric is buried in the ground as detailed.

C. Backfill trench with excavated material, so that fabric is securely buried in the ground to prevent undermining. Tamp soil.

D. Join sections by overlapping fabric between two (2) stakes. Set stakes simultaneously. Overlap by minimum six (6") inches, fold, and staple to prevent sediment bypass.

E. Attach silt fence securely to stakes spaced no more than eight (8' o.c.) feet on center. Secure fence fabric to stake with minimum three one (1") inch staples.

F. Toward the end of the project, when site is stabilized and as directed by the Architect, remove silt fence and correct lawn area around removal to a smooth, neat, well-draining condition.

3.8. RIP RAP:

A. Place and install rip rap where shown on drawings. Do not leave jagged, sharp pieces of stone facing up.

B. Level out stone to provide smooth transition to adjacent finish grades.

3.9. TEMPORARY SEEDING AND MULCHING:

A. Provide temporary seeding of topsoil stockpile immediately.

B. When necessary and as directed by the Architect, provide temporary seeding on disturbed areas at no additional cost to the Owner.

3.10. PERMANENT SEEDING:

A. Install as described in Section 329201.

3.11. SPILL RESPONSE EQUIPMENT:

Use per manufacturer's recommendations and as directed by the NYSDEC, or other governing agencies.

3.12. CLEAN UP:

A. During the contract and at intervals as directed by the Architect and as erosion, sediment and pollution control procedures are completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, and neat condition.

B. Clean storm ponding areas, catch basins and detention basins: Clean out contaminants, sediment, rubbish, construction debris, foreign objects and accumulated floatables from chambers and ponding areas thoroughly, immediately prior to final acceptance.

END OF SECTION

SECTION 321201 - ASPHALT PAVING

PART 1. GENERAL

1.1. DESCRIPTION OF WORK:

A. The extent of asphalt paving is shown on the drawings.

B. Asphalt Paving work includes, but is not limited to, the following:

1. Soil Stabilization Fabric
2. Granular Base Course
3. Asphaltic Concrete
4. Bituminous Tack Coat
5. Painted Lines and Traffic Markings
6. Self-Adhering Waterproof Membrane
7. Hot Pour Crack Sealing and Filling
8. Field Quality Control
9. Clean up

C. Provide all materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2. RELATED WORK SPECIFIED ELSEWHERE:

A. Section 311201 - Site Preparation

B. Section 312201 - Site Earthwork

C. Section 334001 - Storm Drainage

1.3. REFERENCES:

A. The latest editions of the following Standards, as referenced herein, shall be applicable:

1. New York State Department of Transportation Standard Specifications, Section 402 - "Hot Mix Asphalt (HMA) Pavements" and 407 - "Bituminous Tack Coat"
2. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
3. American Sports Builders Association (ASBA) Asphalt Guidelines, latest edition

B. The following reference standards shall apply for Testing and Inspection:

1. ASTM D1074: Standard Test Method for Compressive Strength of Bituminous Mixtures
2. ASTM D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Mixtures Using Paraffin-Coated Specimens.
3. ASTM D2041: Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

4. ASTM D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-absorptive Compacted Bituminous Mixtures
5. ASTM D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
6. ASTM D3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
7. ASTM D3549: Standard Test Methods for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
8. NYSDOT Materials Method 28 Friction Aggregate Control and Test Procedures

C. The following reference standards shall apply for pavement markings:

1. ASTM D562, D711, D1475, D1640, D2369, D3723, D3960.
2. DOT Code of Federal Regulations, Hazardous Materials and Regulations Board, Reference 49CFR, ICC Regulations
3. Federal Specification TT-P-115E, Type III (Type I if V.O.C. compliance)

D. Additional testing required, only if directed in writing by Architect, due to asphalt installation and material issues:

1. ASTM C295: Standard Guide for Petrographic Examination of Aggregate
2. ASTM D1560: Standard Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus
3. ASTM D4125: Standard Test Methods for Asphalt Content of Bituminous Mixtures by the Nuclear Method
4. ASTM D5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
5. ASTM D6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
6. ASTM D6931: Standard Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures
7. ASTM D7312: Standard Test Method for Determining the Pavement Shear Strain and Complex Shear Modulus of Asphalt Mixtures Using the Superpave Shear Tester

1.4. SUBMITTALS:

A. Provide Paving Contractor experience requirements, as outlined in "Quality Assurance" of this specification section, for the following:

1. General Paving

B. Provide Asphalt Producer Vendor Certificate and proof of quality control monitoring as outlined in "Quality Assurance" of this specification section.

C. Provide material certificates showing content/mechanical analysis for the following:

1. Asphaltic Concrete Mix Design with Authorization Signature:

a. Type/name of mix (less than 24 months old)

b. All aggregates gradations and quality measurements
c. Plot (0.45 power graph) of the final aggregate blend
d. Bulk specific gravity of all aggregates and final aggregate blend including worksheets for natural (virgin) as well as reclaimed asphalt pavement (RAP)
e. Grade of asphalt binder (PG) being used
f. Optimum percent asphalt binder (Pb)
g. Mix air voids at optimum (Va)
h. Bulk specific gravity of mix at optimum
i. Theoretical maximum specific gravity of mix at optimum
j. Voids in the Mineral Aggregate (VMA) and Void Filled with Asphalt (VFA)
k. Dust to total asphalt content (AC) ratio
l. All design data and associated design curves

2. Bituminous Tack Coat

D. Provide Manufacturer's Product Data (MPD) for the following:

1. Soil Stabilization Fabric
2. Painted Lines and Traffic Markings
3. Self-Adhering Waterproof Membrane
4. Hot Pour Crack Sealing and Filling

E. Provide shop drawings for the following:

1. Painted Lines and Traffic Markings: Shop drawings indicating sizes, shapes, patterns, and colors of markings, including manufacturers and types of paint.
2. Owner to approve all paint colors prior to installation.

F. Submit Asphalt Placement Work Plan, indicating: paving pass widths, paving directions, site access, and timing/coordination of any site equipment installation (posts, boxes, fencing, etc.) indicated in 3.3 of this specification section. Supply Owner with yield calculations for all asphalt paving products and materials used on the project as part of the work plan.

G. Field Quality Control test reports as indicated in this specification section.

1.5. QUALITY ASSURANCE:

A. Paving Contractor Experience Requirements:

1. General Paving: Contractor shall have the experience of at least five (5) years in business. Paving superintendent has a minimum of three (3) years' experience as a paving crew operating foreman.

B. Asphalt Testing and Inspection Services:

1. The Owner will employ and pay for the services of an Independent Testing Agency to provide testing and inspections of asphalt pavements.

2. The services and the information provided by the Testing Agency are provided for the sole benefit of the Owner. The information is provided to the Contractor for the sole purpose of being aware of what is being reported.
3. The Contractor is solely responsible for assuring the work complies with the Contract Documents in all respects and may not rely on the testing agency for this or any other assurances. The Testing Agency and their representatives are not authorized to revoke, alter, relax, enlarge, or release any of the requirements of the Contract Documents, approve or accept any portion of the work, perform or excuse any duties of the Contractor, or be involved in the scheduling of any work.
4. Asphalt paving materials and operations shall be tested and inspected as the work progresses. Failure by the Testing Agency to detect any defective work or material shall not in any way prevent later rejection (when such defect is discovered) nor shall it obligate the Owner for final acceptance.

C. Asphalt producer shall monitor production according to the procedures of NYSDOT Material Method 28 Friction Aggregate Control and Test Procedures. Asphalt producer shall be a New York State approved/certified HMA (Hot Mix Asphalt) manufacturing facility.

1.6. JOB CONDITIONS:

A. Job conditions in Section 312201 apply.

B. Atmospheric conditions for applying courses:

1. Hot mix asphalt shall generally arrive on the project site between 270°-300° F. (per asphalt producer recommendations).
2. Place asphalt concrete wearing course or bituminous surface treatment only when atmospheric temperature is above 50 degrees F. and rising, and when asphalt binder course is thoroughly dry.
3. Place binder course only when air temperature is above 45 degrees F. and rising and when asphalt base course or granular stone base course is thoroughly dry.

C. Grade Control: Establish and maintain required lines and elevations.

D. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. Obtain and pay for permits required by local authorities.

E. Construction Review and Testing: Notify and coordinate with the Independent Testing Agency and Architect when the subgrade is shaped and ready for proof rolling. Also, when the granular base course is fully installed, compacted and ready for density testing. Protect subgrade and subbase at all times.

F. When staging or scheduling delays occur and wearing course cannot be installed directly after binder course installation before winter, provide temporary asphalt transition ramp/collar around drainage structures in paved areas and at handicap ramps to prevent damage by snowplow. Remove prior to installation

of wearing course. Power wash surface and apply asphalt tack coat, as specified, prior to wearing course installation, at no additional cost to the Owner.

1.7. DELIVERY, STORAGE, AND PROTECTION:

A. Deliver all materials to the job site with all labels intact and legible at time of installation.

B. Store materials off ground under cover. Protect from damage or deterioration.

C. Handle materials to prevent damage to surface, edges, ends and factory applied finishes of items. Damaged material shall be rejected and replaced.

PART 2. PRODUCTS

2.1. SOIL STABILIZATION FABRIC:

A. Shall be a heavy duty, commercially manufactured woven polypropylene geotextile. Standard of quality shall be Mirafi 500X, manufactured by TenCate or Architect approved equal.

2.2. GRANULAR BASE COURSE AND GRAVEL PAVEMENT:

A. Shall be as specified in Section 312201.

B. The graded and designed granular base below all new Asphaltic Concrete Pavements shall be constructed, tested, and prepared in accordance with Section 312201 - Site Earthwork of the Contract Documents.

2.3. ASPHALTIC CONCRETE:

A.

Pavement Types	Percent Asphalt*
37.5mm Type 1 Base Course	4.8% Asphalt
19.0mm Type 3 Binder Course	4.8% Asphalt
12.5mm Type 6 Top Course	6.3% Asphalt

* Percentage of Asphalt is approximate and shall be based off actual project submittals provided by the Asphalt Producer.

B. Hot Mix Asphalt Top Course: Pavement shall meet the minimum requirements for 12.5 mm (Type 6) SUPERPAVE Hot Mix Asphalt Top Course (75 gyrations), with a PG 64-22 Binder as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 15% of the total mix.

C. Hot Mix Asphalt Binder Course: Pavement shall meet the minimum requirements of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled

Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.

D. Hot Mix Asphalt Base Course: Pavement shall meet the minimum requirements of 37.5mm SUPERPAVE Hot Mix Asphalt Base Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.

E. The coarse aggregate used in HMA shall be sound, angular crushed stone or crushed gravel. The fine aggregate shall be well graded, moderately sharp to sharp (angular) sands.

2.4. BITUMINOUS TACK COAT:

A. Material shall consist of an asphalt emulsion, Grade RS-1h, and shall meet the minimum requirements of Section 407, of the current NYSDOT Standard Specifications. Bituminous Tack Coat shall be installed over all new and existing concrete and asphalt pavements and structures prior to the installation of new Hot Mix Asphalt materials. The following application rates shall apply:

1. New Hot Mix Asphalt	0.05-0.07gal/sy
2. Milled Surfaces of Existing Asphalt	0.10-0.15gal/sy
3. Abutting Vertical Edges (drainage structures, appurtenances)	0.05-0.07gal/sy
4. All Styles of Curbs and Gutters	0.05-0.07gal/sy
5. Delayed asphalt installation of HMA Courses	0.10-0.15gal/sy

2.5. PAINTED LINES AND TRAFFIC MARKINGS:

A. The extent of the pavement markings shall match the extent, location and composition of pavement markings existing at the site prior to start of work where applicable.

B. The work includes but is not limited to the following: parking stall divider lines, wheelchair legends, "STOP" legends, "NO PARKING" legends, pick-up zone, striping and legends, directional arrow legends, diagonal striping, center line striping, fire lane striping, student area line striping, and other pavement markings as may be shown on the plans.

C. Provide ready-mixed, one component waterborne traffic line paint. Standard of quality shall be: Hotline Fast Dry Waterborne Traffic Marking Paint (Long-Line) as distributed through Sherwin-Williams; or Architect approved equal.

1. Colors (as approved by the Owner in writing):

a. Yellow: 1 Gallon & 5 Gallon, Product Number TM2321
b. White: 1 Gallon & 5 Gallon, Product Number TM2320

2. Paints shall contain all necessary co-solvents, dispersants, wetting agents, preservatives, and all other additives, so that paint shall retain viscosity. Halogenated solvents shall not be permitted.

3. Volatile Organic Compound (VOC) content shall not exceed 250 grams maximum per liter of paint as determined in accordance with ASTM D 3960 test, excluding water and exempt solvents.

2.6. SELF-ADHERING WATERPROOF MEMBRANE:

A. Shall be a composite membrane designed specifically to prevent water from permeating joints and cracks. Product shall be comprised of self-adhering rubberized asphalt and durable poly propylene non-woven fabric with a "peel-n-stick" release. Standard of quality shall be 12" Mirafi MTK as manufactured by TenCate or Architect approved equal.

B. Priming material composed of refined asphalt and rapid drying solvent meeting ASTM D41. Polyguard 650 RC Liquid Adhesive or Architect approved.

C. Contractor to provide 300 linear feet in Base Bid.

2.7. HOT POUR CRACK SEALING AND FILLING:

A. Single component, hot applied asphalt crack and joint sealant capable of withstanding temperatures of up to 450° without experiencing polymer degradation.

B. Shall be supplied in solid blocks comprised of heat stabilized polymers and asphalt.

C. Meeting the following material requirements when tested in accordance with ASTM D5329. (see chart below)

Chemical & Physical Analysis

Recommended Application Temperature	350-400°F
Maximum Heating Temperature	450°F
Cone Penetration at 25°C	50 max.
Flow at 60°C, mm	0.
Softening point	200°F Min.
Flexibility 0°F	(1" Mandrel)-Pass
Specific Gravity	1.17
Asphalt Compatibility	Passes

D. Standard or quality shall be Crack Master Supreme as manufactured by Thorworks Industries, Inc., 800-395-7325, www.thorworks.com or approved equal.

PART 3. EXECUTION

3.1. PREPARE SURFACE:

A. Prior to commencement of asphalt paving, all excavations, drainage, utilities, backfilling, fencing, bollards, storm structures, curbing installations, adjustments, proof-rolling and density test procedures shall be complete to the satisfaction of the Architect.

B. Prior to commencement of tack coat and asphalt paving within pavement milled areas, as shown on the plans, all cracks and joints in the milled pavement surface shall be prepared and filled in accordance with the project specifications. Any oil or grease spots shall be scraped and treated to prevent bleeding through the tack coat.

C. Saw cut, using straight and true lines, all existing asphalt pavements to remain in place with straight, neat edge for abutting against proposed asphalt pavement.

D. Provide and confirm field quality control as described in Section 312201 for pavement subgrade and granular base course stone.

3.2. CONSTRUCT PAVEMENT GRANULAR BASE COURSE:

A. General: Consists of placing granular base course material, in layers of specified thickness, over prepared subgrade and fabric to support a pavement course.

B. Grade Control: Provide engineering layout per Section 312201 and grade stakes. During construction, protect grade stakes; maintain lines and grades including crown and cross-slope of each course.

C. Install soil stabilization fabric after subgrade has been acceptably compacted and proof rolled. Install soil stabilization fabric as recommended by the manufacturer AND;

1. Lay fabric in direction of construction traffic.
2. Overlap fabric side to side and end to end a minimum of two (2') feet.
3. Establish reasonable compaction and rut stability before using heavy or vibratory compaction equipment.

D. Placing:

1. Place granular base material over soil stabilization fabric, on prepared subgrade in layers of uniform thickness, conforming to the asphalt pavement details on the drawings.
2. Place granular base material in a maximum of six (6) inch layers and compact with a vibratory or 10 ton smooth wheeled roller.

E. Provide density testing as described in Section 312201.

F. Surface Smoothness: Test finished surface for smoothness. Surface will not be acceptable when it deviates more than 3/8" measured by a 10 foot straightedge, in any direction.

G. The finished grade of the granular base course shall be verified to ensure that the final finished product of the bituminous concrete pavement surface will be installed to the lines and grades of the existing pavements and proposed elevations surveyed by the Contractor prior to the start of the paving work.

3.3. PLACE ASPHALT MIX:

A. General:

1. The Contractor shall submit a paving plan, indicating intended direction of paving, number of pulls, etc. for approval prior to the start of paving operations.
2. Joints: Saw cut vertical straight, neat edges for joints required. Joints shall be sharp and clean, conforming to shapes drawn on drawings. Ragged joints will not be accepted.
3. Mill two (2') feet into surface of adjacent asphalt so joints do not line up or "stack".
4. Place bituminous tack coat to all surfaces as indicated in this specification. When pavement surface temperature is above or below the 75-130 degrees F. range, the grade of asphalt emulsion must be modified according to NYSDOT standards. Tack coat shall not be applied to a wet surface or when the pavement surface temperature is below 45 degrees F.
5. Place asphalt on approved prepared surface, spread and strike-off.
6. Spread mixture at minimum temperature of 225-240 degrees F. Place inaccessible and small areas by hand. Hand work shall be minimized to ensure the best possible finished surface.
7. Place each course to required grade, cross-section, and compacted thickness.
8. Paving operations shall not be scheduled when ample time does not exist to place, compact, and finish roll the hot mix asphalt during daylight hours and prior to rainfall.

B. Pavement Placing: Shall be installed in accordance with Section 402-"Hot Mix Asphalt (HMA) Pavements", of the current NYSDOT Standard Specifications.

C. Paving Equipment:

1. Must be capable of placing, spreading, and finishing courses of HMA to the specified thickness.
2. HMA shall be free of marks, segregation and be placed to the required uniform elevation with a smooth texture not showing tearing, shoving, or gouging.
3. Auger extensions are required while pavers are extended beyond the basic screed width.
4. Paving equipment shall be self-propelled and capable of maintaining the line and grade shown on the plans with suitable electronic equipment. The screed shall be straight and true with no bow and utilizing a vibratory screed. Paving equipment should have fully functional screed heaters and joint preheaters.

D. Asphaltic Concrete shall be installed as follows:

1. Medium Duty Asphalt Pavement: Installed in two (2) lifts consisting of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by 12.5mm SUPERPAVE Hot Mix Asphalt Top Course.

2. Heavy Duty Asphalt Pavement: Installed in three (3) lifts consisting of a 37.5mm SUPERPAVE Hot Mix Asphalt Base Course overlain by 19.0mm

SUPERPAVE Hot Mix Asphalt Binder Course overlain by 12.5mm SUPERPAVE Hot Mix Asphalt Top.

E. Place in strips not less than ten (10') feet wide, unless otherwise acceptable. In placing each succeeding pass after the placement of the initial pass, the screed of the paver shall be set such that it overlaps the preceding pass by 6" and be sufficiently high such that when compacted, a smooth joint is produced. Prior to pinching the joint, the excess material shall be pushed onto the edge of the new pass with a lute. Excess material shall be removed.

F. After first lift has been placed and rolled, place succeeding lifts and extend rolling to overlap previous lifts. Where possible, top course shall be placed at right angles to binder course and in the direction that the drainage flows. Where this is impractical, offset joints of the two courses by a minimum of two (2') feet so upper and lower joints do not align.

3.4. ROLL ASPHALT MIX:

A. General:

1. Rollers shall conform to the manufacturer's specifications for all ballasting. At least one vibratory roller shall be required for each project, with two rollers required as a minimum. (Three rollers shall be required when tonnage is greater than 300 tons/day.)
2. Rollers shall be of a good condition and capable of compacting the HMA to the minimum in-place density required by this specification. Compact asphalt with a nominal 10 ton steel wheel roller or pneumatic rubber tired roller. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
3. Begin rolling when mixture will bear roller weight without obvious or excessive displacement.

B. Finish Rolling: Each lift of the Asphaltic Concrete Pavement shall be mechanically rolled and compacted to the finished thicknesses specified in the Contract Documents. The pavements shall be compacted to a minimum of 94%-97% (95%-102% at longitudinal joints) of the materials theoretical density as determined by AASHTO Method T 209 and an air void percentage of 5%-6% maximum.

C. Patching: Remove and replace paving areas mixed with foreign materials, dirt, and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

D. Joints:

1. The Contractor shall sequence the installation and orientation of all Asphaltic Concrete Pavements such that the minimum numbers of longitudinal and transverse joints are produced and in accordance with the approved Asphalt Placement Work Plan.
3. Neat, straight butt joints between successive passes. Offset joints a minimum of six (6") inches between lifts of asphalt.

3. When repairs or staging of work occurs, make neat vertical saw cut between old and new work to create butt joint. Heat joint prior to pouring. Cold joints are not acceptable.
4. Apply bituminous tack coat to all surfaces and rates indicated under "Bituminous Tack Coat" of this specification section. Tack coat shall not be required on abutting vertical edges for pavements placed in the same day.
5. Minimize construction, longitudinal, and transverse joints left open for an extended period of time.
6. Construct longitudinal joints by paving in a hot fashion with a temperature of not less than 220°F to ensure maximum performance and adhesion.
7. Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements of this specification.
8. Cut straight and true (vertical construction or transverse joints if the material has cooled to less than 220°F prior to the placement of the next pass to ensure the best performing joint possible.

F. Edges: Roll at 45 degrees as detailed, creating clean edge conforming to shapes indicated on the drawings. Ragged edges will not be accepted. Return and saw cut ragged edges at no additional cost to the Owner as directed by the Architect.

G. The final finished grades of the new Bituminous Concrete Pavements must be smooth and true to the contours and shall be installed to the lines and grades of the site prior to start of construction. The final finished grades shall match adjacent pavement surfaces and concrete slabs, aprons, and doorways.

H. Construction Delays (over 48 hours): When placement of the wearing course over the binder course is delayed over 48 hours, thoroughly clean existing surface of dirt, oil and other debris by pressure washing and sweeping. Place bituminous tack coat as specified in this section.

3.5. ASPHALT TOLERANCES:

A. Thickness and Density: Compact each asphalt course to produce the thickness indicated on the drawings within the following tolerances:

1. Base Course: Plus or minus 1/2-inch
2. Binder Course: Plus or minus 1/4-inch
3. Wearing Course: Plus or minus 1/8-inch

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. For Asphalt Concrete:

Base Course Surface: 3/8"
Binder Course Surface: 1/4"
Wearing Course Surface: 1/8"

C. Asphalt Cores: Shall be provided as indicated under "Field Quality Control" of this specification.

3.6. FIELD QUALITY CONTROL:

A. The Owner's Testing Agency shall provide the following in the daily report at a minimum:

1. Verify the following for the asphalt mix design prior to asphalt placement:

a. The asphalt mix design has been approved.
b. The asphalt mix design specifies the minimum relative compaction and the methods required to determine maximum density.

2. Verify the asphalt subgrade has been acceptably proof-rolled. (See Section 312201.)
3. Inspect /test aggregate base course material for in-place density (95%) and thickness. Test materials for gradation classification, and physical properties. (See Section 312201.)
4. Inspect/test asphalt wearing course material for compaction during placement and conduct thickness measurements during lay-down. Take temperature of the asphalt mixture and compare actual temperature with the approved asphalt mixture design range. As a minimum, perform the following inspection/tests:

a. Collect trip tickets from trucks delivered to the site and verify correct mix design being used for the project.
b. Temperature tests: one per truck.
c. Lay down thickness (uncompacted): one per strip or 500 square feet minimum
d. Verify equipment rolling pattern and passes to ensure proper compaction: one per day
e. Density test (daily lab density): one test per 5000 square feet minimum
f. Hot mix samples (laboratory testing for density per ASTM D1188): one per day
g. Thickness per ASTM D3549 and density samples per ASTM D2950 by a properly calibrated nuclear asphalt testing device. If there is a disagreement between tests done by ASTM D2950 and ASTM D1188, the values done by ASTM D1188 will govern: one test per 20,000 square feet (surface lift), one test per 10,000 square feet (base lift)
h. Air voids per ASTM D3203 or D2726: one test per 5000 square feet minimum
i. Verify compaction at the joints and seams. The completed paved surface to be true to grade and cross section. Verify smoothness by using an unleveled 10 foot straightedge and ensuring no gap at any point between straightedge and pavement exceeds surface smoothness requirements above except at interception or at changes of grade.
j. The screed/lay down thickness tolerance shall be between 1/8 to 3/16 inches greater than the required asphalt minimum layer

requirement. When screed depth is set for the exact thickness as specified, immediately notify the Owner's Representative and Contractor that the installed asphalt thickness may be deficient to achieve the specified minimum thickness. Identify areas of non-complying thickness and attach a drawing identifying the areas to the daily field report.

k. Immediately notify the Owner's Representative and Contractor when paving is being conducted in cold weather and asphalt temperatures are below or above the design mix range.

l. Check the surface grades and drainage patterns. Identify on a drawing all paved areas that are holding water after asphalt placement and notify the Owner's Representative and Contractor. Small ponding areas (bird baths) larger than two (2') feet in any dimension are not acceptable. When this test proves that surface conditions are not acceptable, the Contractor will be responsible for correcting the problem areas. Install a one (1") inch shim coat of wearing course material, or other means acceptable to the Architect.

m. Verify tack coat and edge coat have been applied at the proper rate.

5. Asphalt Cores: Shall be as directed by the Architect.

a. Prior to final acceptance of the asphalt and before lining or other surface materials (color court surfacing, resilient track surfacing, etc.) are placed, the Owner's Testing Agency shall core 3" diameter areas of the asphalt surfacing where directed by the Architect. Consistency, density, thickness, and tensile strength per ASTM D6931 will be evaluated.

b. Patch core areas as directed by the Architect to match adjacent density, texture and thickness.

c. Coordinate day to day scheduling with the Testing Agency.

d. If cores vary significantly from the contract requirements, additional cores will be performed by the Testing Agency as directed by the Architect. Once the overall general quality is determined, provide remedial work as directed by the Architect to achieve the quality and consistence as specified.

B. Unacceptable Paving: Remove and replace unacceptable paving as directed by the Architect, immediately and without argument or delay. Correction of deficient areas in the wearing course shall be done by sawcutting and removal of defective area of work. Tack coat shall be applied to all edges and the pavement shall be replaced. Shimming or skin patching of the wearing course shall not be permitted. Correction of deficient areas within the binder course shall be corrected by sawcutting and milling high spots, and truing and leveling low spots or as directed by the Architect.

3.7. SURFACE PROTECTION:

A. Protection: After final rolling and sealing, do not permit any type of vehicular or construction traffic on pavement until it has cooled and hardened as recommended by the producer/manufacturer, minimum of 48 hours.

B. Provide protection including, but not limited to, fencing, traffic cones, barrels, lights, reflective signs, flagpersons and barricades until mixture has cooled and attained its maximum degree of hardness.

3.8. PAINTED LINES AND TRAFFIC MARKINGS:

A. Cleaning: Sweep and clean surface to eliminate loose material and dust. Remove dirt, oils, and other foreign matter. All surfaces to receive pavement markings shall be clean and in good condition to accept pavement markings.

B. Coordinate provisions for installation with work of other trades.

C. Locate to alignment and dimensions as shown on drawings and/or approved by Owner.

D. Painted markings shall meet regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as published by NYSDOT, Division of Traffic and Safety, Section 262.25 and figure PM-42; and they shall comply with the most recent version of the Americans with Disabilities Act Standards for Accessible Design.

E. Protect: Adjacent surfaces and other items to remain with tape, drop cloths, or other Architect approved means.

F. Application: One coat according to manufacturer's recommendations resulting in a dense, opaque application without any ghosting of former pavement markings showing through. Overspraying along edges will not be accepted. Edges shall be sharp and crisp, to the shapes required by the drawings.

1. Line painting shall be installed at the recommended DFT (dry film thickness) after paving is in place. The second coat shall be applied at the recommended DFT no later than thirty (30) days after the completion of work.
2. Apply paint materials using clean brushes, rollers or spraying equipment.
3. Apply paint materials as a rate not exceeding those recommended by the paint manufacturer for surfaces being painted, less 10% of losses
4. Comply with manufacturer's recommendations for drying time between coats. The minimum DFT must be met. Apply additional coats as needed to achieve minimum total specified DFT of the paint system.
5. The minimum required total Dry Film Thickness (DFT): The DFT shall be the minimum required thickness as measured in mils.
6. System coverage requirements minimum total thickness (unless otherwise noted):

    a. 13.0 mils TO 15 mils

7. Exterior Paint Systems: Provide the following paint systems as indicated: (Colors to be approved by Owner.)

    a. Parking stall, division and limit lines shall be 4" in width, true and straight. Color: White

b. Stop legends shall be as detailed on drawings. Color: White
c. Wheelchair legends shall be as detailed on the drawings. Color: Blue background with white symbols. Parking stall striping shall be Blue at handicap stalls only
d. Diagonal striping Handicapped. Color: Blue
e. Diagonal striping Loading Zone. Color: Yellow
f. Directional signage shall be as detailed on the drawings. Color: by Owner
g. Center line striping shall be 4" in width as detailed on the drawings. Color: By Owner
h. Fire line striping shall be 4" in width. Color: by Owner

G. Allow 48 hours minimum curing time for paint before allowing traffic on surfaces. Clean up thoroughly including all protective tape, spilled paint, and debris. All parking area marking and painting to be protected by appropriate traffic barriers, lighted if necessary, so located as to prohibit parking and traffic until traffic lines are completed and properly dry.

3.9. SELF-ADHERING WATERPROOF MEMBRANE:

A. Surface Protection: Existing pavement surface must be cleaned of all loose dirt and debris and be dry. Cracks wider than 3/8-inch should be filled with suitable crack filler. Severally spalled or other distressed areas must be repaired according to this specification. Note: Commercial crack filler expands under the heat of any overlay and therefore the crack should be filled level or just below the existing pavement surface.

B. Primer: (Surface shall be primed as follows):

1. Primer must be used on all milled surfaces. The liquid adhesive shall be placed on the surface, at a minimum rate of 250 square feet per gallon on milled surfaces.
2. The primer must be completely dry prior to application of the membrane.
3. Primer may be applied using brushes, rollers or by spraying at the prescribed rate of application. Never apply primer to wet or frozen surfaces.
4. Areas primed and not covered with membrane within 24 hours should be re-primed. Smoothness and porosity of existing asphalt surface may affect coverage rate. Do not apply liquid adhesive at heavier rates than recommended. Excessive material build-up will delay drying and membrane application.

C. Temperature: The surface temperature should be 45 degrees F. and above when installing self-adhering waterproof membrane. Storage temperature should not exceed 125 degrees F.

D. Installation:

1. Center the roll over the joint or crack to be treated with the release paper attached. Allow for a material overrun of 4 to 6 inches beyond each end of the crack to ensure a waterproof seal. Cut the membrane with utility knife. Install the self-adhering membrane by removing release paper.

2. Material should be laid smooth and adhere well to the existing pavement by rolling the membrane with a pickup truck or pneumatic roller. A stiff broom can also be used to aid adhesion.

E. Tack Coat: A standard NYSDOT approved tack coat is applied over the self-adhering membrane and the remaining portion of the surface before placing the hot mix asphalt layer as specified.

3.10. HOT POUR CRACK SEALING AND FILLING:

A. The crack must be free from moisture, dust, and loose aggregate. Routing or wire brushing are preferred methods followed by a compressed air heat lance immediately prior to sealing. The substrate and air temperature must be above 45°F.

B. Shall be melted in direct fired or oil jacketed melters. Material should reach recommended pouring temperature of 350-400°F. Fresh material may be added as sealant is used.

C. Apply heated crack filler using either a pump and wand system or a pour pot. For best results the sealant depth to width ratio should not exceed 2 to 1 (i.e. 2-inches deep to 1-inch wide). The cooled sealant height should not exceed 1/8" above surrounding pavement. Using a sealing shoe or squeegee, band the material 2 to 3 inches wide over the crack.

3.11. CLEAN UP:

During the contract, and at intervals as directed by the Architect, and as asphalt paving is completed, clear the site of extraneous fabric, gravel, asphalt and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 321201

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of site concrete work is shown on the drawings and includes formwork, reinforcement, accessories, cast in place concrete, installation of embedded items, finishing, curing, mix designs, testing and acceptance requirements for concrete.

B. Site Concrete work includes, but is not limited to, the following:

1. Concrete walks and pads
2. Concrete curbs, gutters, walls, and stairs
3. Concrete curb ramps with detectable warning system
4. Concrete footings, bases, foundations
5. Exterior anchoring cement non-shrink grout
6. Concrete scheduling April 1 to October 15
7. Clean up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 312201 - Site Earthwork

B. Section 334001 - Storm Drainage

1.3 REFERENCES

A. ACI 301-96 - Specifications of Structural Concrete for Buildings

B. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement

C. ASTM C31 - Standard Practice for Making and Curing Test Specimens in the Field

D. ASTM C33 - Concrete Aggregate

E. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

F. ASTM C94 - Ready-Mixed Concrete

G. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars

H. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete

I. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)

J. ASTM C150 - Portland Cement

K. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete

L. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method

M. ASTM C260 - Air Entraining Admixtures for Concrete

N. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete

O. ACI 315 - Details and Detailing Concrete Reinforcement

1.4 SUBMITTALS: (See Section 311201, 1.5)

A. Shop Drawings required for:

1. Concrete stairs, walls, ramps, footings, and foundations showing reinforcing

B. Manufacturers Product Data (MPD) and Samples where indicated are required for the following:

1. Expansion Joint and Sealant (Vertical and Horizontal): MPD and Color Samples
2. Water Based Curing and Sealing Compound
3. Slip Dowel System
4. Fiber Reinforcement: (Curbs and Gutters Only)
5. Cold Weather Admixture
6. Hot Weather Admixture
7. Air Entrainment
8. Detectable Warning System
9. Form Release
10. Exterior Anchoring Cement Non-Shrink Grout
11. High Strength Anchoring Epoxy System
12. Concrete Bonding Agent

C. Submit proposed 4,500 psi concrete mix design and test data in accordance with ACI 301 to the Architect for review prior to commencement of the work.

1. Indicate the locations and elements for which the mix will be used.
2. Include in the concrete mix design all required or proposed admixtures necessary to facilitate the installation of the concrete by the means and methods selected by Contractor for this project.

D. Mill test certificates and/or test reports for cement indicating compliance with these specifications.

1.5 QUALITY ASSURANCE

A. Concrete Testing Services: The Owner shall employ an acceptable independent testing laboratory to perform materials evaluation, testing of concrete mixes, and

quality control testing. Coordinate day to day scheduling with the testing agency. Field technician shall be ACI Certified Grade 1 Field Technician.

B. Construct and erect concrete formwork in accordance with ACI 301 and 347.

C. Perform concrete reinforcing work in accordance with ACI 301.

D. Perform cast-in-place concrete work in accordance with ACI 301.

E. Conform to New York State Building Code.

F. Field quality control tests are specified in Part 3 - Execution.

1.6 JOB CONDITIONS

A. Job conditions in Section 312201 apply. Provide ample and skilled manpower for concrete installation which is a recognized time sensitive procedure.

B. All concrete work shall conform to American Concrete Institute (ACI) 304R-00 "Guide for Measuring, Mixing, Transporting and Placing Concrete".

C. Do not install concrete work when the temperature of the outside air is below 50 degrees F. and falling unless suitable means acceptable to the Architect are provided to protect work from cold and frost and ensure that mortar and concrete will cure without freezing as indicated in "Cold Weather Concreting" below.

D. Cold Weather Concreting: Provide non-chloride accelerating water reducing admixture in site concrete work placed at ambient air temperatures below 50 degrees F. (10 degrees C.). Comply with International Masonry Industry All-Weather Council cold weather construction and protecting recommendations and American Concrete Institute 306R-10 "Guide to Cold Weather Concreting."

E. Hot Weather: Provide water reducing retarding admixture in site concrete work placed at ambient air temperatures above 80° F. Comply with American Concrete Institute 305R-10 "Guide to Hot Weather Concreting."

F. Construction Review: Notify the Architect/Geotechnical Engineer when stairs, retaining walls, walks, ramps, curbs and pads are formed and ready to receive concrete. Radius form layout shall be inspected and approved by the Architect.

G. Schedule: Unless otherwise directed in writing by the Architect, construct site concrete work from April 1 to October 15. This permits a minimum 30 day dry curing period prior to possible application of deicing chemicals by the Owner.

H. Site concrete work performed between October 16 and March 30 will require an additional written one (1) year guarantee with the understanding that above average concrete deterioration and replacement by the Contractor is likely.

1.7 ADA REQUIREMENTS

A. GENERAL: Concrete work shall comply with the Americans With Disabilities Act as described in the 2010 ADA Standards issued by the Department of Justice (DOJ) and the Department of Transportation (DOT) or latest edition, shall be used.

B. Curb ramp and concrete walk surfaces shall meet the following tolerances:

1. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes.
2. Thresholds at doorways shall not exceed 3/4" in height for exterior sliding doors or 1/2" for other types of doors. Raised thresholds and floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2.
3. Detectable warning system shall cast in place for the safety and convenience of the visually impaired. Contractor shall have a minimum of three (3) years experience with materials and installation.

PART 2 - PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

A. Forms: Either steel or wood, exterior type softwood, PS1, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects, extending the full depth of concrete. Concrete walks which require radius form work shall be set with flexible forms, conforming to the shapes and dimensions as indicated.

B. Lumber: PS 20.

C. Form Ties: Snap-off, metal type of fixed length, cone type.

1. Ties shall be left in place and equipped with swaged washers or other approved devices to prevent seepage of moisture along the tie.
2. Depth of Breakback: Minimum one (1") inch.
3. Unless otherwise noted, provide form ties, which will not leave holes larger than one (1") inch diameter in concrete surface.

D. Dovetail Anchor Slot: Galvanized steel, form filled, release tape sealed slots; bend tab anchors.

E. Form Release Agent: Shall be non-staining and non-residual. Increte Wall Form Release manufactured by Increte or Architect approved equal.

2.2 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish, free of rust and/or oxidation. Reinforcing bars shall be bundled and tagged with grades and suitable identification markings, shall be waterproof, and shall not be removed until steel is placed.

B. Steel Welded Wire Reinforcement ASTM A185, plain type:

1. Flat Sheets
2. Mesh size: 6 x 6 (standard W1.4 x W1.4, heavy duty W2.1 x W2.1)
3. Free of rust and/or oxidation

C. Reinforcement Accessories:

1. Tie Wire: FS QQ- W-461 G, annealed steel, back, 16-gage minimum.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. They shall provide sufficient supports at close enough spacing so that the steel will carry the weight of the workmen and the fresh concrete without deformation from its specified location.

D. Fabricate concrete reinforcing in accordance with ACI 315.

E. Slip Dowels: Shall be a slip dowel system comprised of a round dowel sleeve and corresponding base. Standard of quality: shall be Speed Dowel as distributed by A.H. Harris, (860) 216-9500 or Architect approved equal.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, Normal-Type 1 or Type II, Portland type.

B. Aggregates (ASTM C33):

1. Fine aggregates: clean, sharp, natural sand.
2. Coarse Aggregates: 3/4" maximum size stone meeting the requirements of New York State Department of Transportation Specification 703.02.

C. Water: Clean and not detrimental to concrete.

2.4 ADMIXTURES

A. Calcium Chloride in concrete is prohibited.

B. Air Entrainment Admixture: ASTM C260, Darex AEA ED or Architect approved equal.

C. Water Reducing Admixture: ASTM C494, Type A; not containing more chloride ions than are present in municipal drinking water.

D. High Range Water Reducing Admixture: ASTM C494, Type F or G; not containing more chloride ions than are present in municipal drinking water.

E. Cold Weather Accelerating Admixture: (Ambient temperature below 50°F.) Non-chloride water reducing accelerating admixture, ASTM C494, Type C, PolarSet as manufactured by WR Grace & Co. or Architect approved equal. Mix at rates recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.

F. Hot Weather Water Reducing and Retarding Admixture: (Ambient temperature above 80° F.) Shall be Daratard series admixture, ASTM C494, Type D, as manufactured by WR Grace & Co. or Architect approved equal. Mix at a rate recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.

2.5 RELATED MATERIALS

A. Expansion Joints:

1. For Radius Applications: Expansion joint filler shall be polyethylene closed cell backing with peel off strip, X-Foam as manufactured by W.R. Meadows or Architect approved equal.
2. For Straight Applications: Expansion joint filler shall be fiber expansion joint with peel off snap-cap, as manufactured by W.R. Meadows or Architect approved equal.

B. Caulking for flat slabs shall be one part elastomeric self leveling polyurethane gray sealant Pourthane SL or Architect approved equal. Caulking for vertical surfaces shall be one component elastomeric gun grade polyurethane sealant Pourthane NS, color as selected by the Owner to match wall stain or Architect approved equal.

C. Fiber Reinforcement for Concrete Gutters and Curbs: Shall be Grace Fibers ¾" long, fibrillated polypropylene fibers as manufactured by WR Grace & Co. or Architect approved equal. Add fibers to concrete at the rate of 2.0 lbs/c.y. and as recommended by the manufacturer.

2.6 COMPOUNDS, HARDENERS, AND SEALERS

A. Water Based, Acrylic, Curing and Sealing Compound: ASTM C309, Type 1, Class A and B, clear or translucent. Standard of quality shall be VOCOMP-20 as manufactured by W.R. Meadows or Architect approved equal.

2.7 CONCRETE MIX

A. Mix and deliver ready-mix concrete in accordance with ASTM C94.

B. Concrete:

1. Compressive Strength (Minimum at 28 days): 4,500 psi
2. Slump (Maximum): 2 to 4 inches
3. Air Entrainment: 6-8.5%
4. Flexural Strength (ASTM C78): 650 psi at 28 days.

C. Use water-reducing admixture in all concrete.

D. Water/Cement Ratio: Maximum 0.42 for 4,500 psi concrete.

E. Cement Factor Per Cubic yard: Minimum 560 lbs. for 4,500 psi concrete.

1. Substitution of fly ash for cement is prohibited.

F. Maximum Size of Coarse Aggregate:

1. General Work: Per ACI 301, 3/4" maximum.

G. Select admixture proportions for normal weight concrete in accordance with ACI 301.

H. Add air-entraining agent to concrete mix for all concrete work exposed to exterior.

2.8 MIXING WATER CONTROL

A. The quantity of mixing water used in the concrete mix shall be determined by the Contractor, except that the Architect/Geotechnical Engineer may direct that such quantity of water be reduced if the slump of the concrete exceeds the specified slump. The Contractor's determination of the quantity of mixing water shall conform to the various limits on water/cement ration and slump specified. Concrete consistency shall be uniform from batch to batch.

B. During the course of the work, the batch plant will make quantitative measured moisture determinations of the aggregates utilized in each batch. Aggregate weights and batch water requirements shall be adjusted accordingly for measured aggregate moisture content.

C. When concrete is transported in units approved for mixing, the addition of not more than 10% of the total design water will be permitted at the job site to obtain initial slump.

1. Any addition of water shall be followed by mixing of at least 30 revolutions in the mixing speed range.
2. No more than two additions of water at the point of deposition before discharge shall be allowed.
3. No retempering of the concrete will be permitted. Retempering is defined as the addition of water after the mix has attained its desired initial slump.

2.9 DETECTABLE WARNING SYSTEM

A. Cast in place vitrified polymer composite (VPC) detectable/tactile warning tiles shall be an epoxy polymer composition with aluminum oxide particles in the truncated domes. Standard of quality shall be Armor-Tile 24" x 48" cast-in-Place Inline Dome Tactile Tile (ADA-C-2448) as manufactured by Engineered Plastics, Inc. 800-682-2525 or Architect approved equal.

B. Color shall be colonial red (Federal No. 20109) or Architect approved equal.

C. Guarantee period shall be five (5) years from substantial completion including defective work, breakage, deformation, heave, and loosening tiles.

2.10 EXTERIOR ANCHORING CEMENT (NON-SHRINK GROUT)

A. For Steel Posts, Fencing and Other Non-Aluminum Elements: Shall be an exterior grade anchoring cement (non-shrink grout) with a min. compressive strength (ASTM C-109) of 7,200 psi at 28 days. Standard of quality shall be Super Por-Rok as manufactured by CGM, Inc., www.cgmbuildingproducts.com, or Architect approved equal.

B. For Aluminum Posts and Elements: Shall be an exterior grade anchoring cement (non-shrink grout) with a min. compressive strength (ASTM C-109) of 7,200 psi at 28 days. Standard of quality shall be Por-Rok as manufactured by CGM, Inc., www.cgmbuildingproducts.com, or Architect approved equal.

2.11 HIGH STRENGTH ANCHORING EPOXY SYSTEM

A. A two-component vinylester adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment.

B. Designed for bonding threaded rod and reinforcing bar elements into drilled holes in concrete and masonry base materials.

C. Standard of quality shall be AC100+ GOLD Vinylester Injection Adhesive Anchoring System as distributed by A.H. Harris, (315) 414-0340, or Architect approved equal.

2.12 CONCRETE BONDING AGENT

A. Shall be a concrete bonding adhesive specifically formulated for permanently bonding new concrete to old concrete in exterior applications.

B. Concrete bonding adhesive applied to appropriate substrates will achieve tensile bond strengths typical of 150 psi in 28 days.

C. Standard of quality shall be Quickrete Concrete Bonding Adhesive or Architect approved equal.

PART 3 - EXECUTION

3.1 CONCRETE WALKS, PADS, AND RAMPS

A. Surface Preparation: Remove loose material from the compacted subgrade surface immediately before placing concrete. Remove any standing water, mud, debris, frost, snow, ice from surfaces upon or against which concrete is to be placed.

B. Proof-roll prepared subgrade surface to check for unstable areas and the need for additional compaction. Do not begin concrete pour until such conditions have been corrected, subgrade is compacted to 95% and ready to receive concrete.

C. Form Construction: Construct to required size and shape. Brace and secure to maintain alignment, elevation and position. Check completed formwork for

grade and alignment, prior to installing concrete. Clean forms as needed to removed foreign matter.

D. Install welded wire mesh on concrete brick or mesh chairs to proper level in maximum lengths possible. Offset end laps in both directions. Splice laps with tie wire. Lifting mesh after concrete pouring is not acceptable.

E. Prepare concrete mixture including the following:

1. Add hot weather or cold weather admixture to accommodate field weather conditions.

F. Concrete Testing: Will be performed as described in Part 3, "Field Quality Control" of this specification section.

G. Conveying:

1. Convey concrete by means that will prevent segregation and loss of mortar form the mix.
2. Provide adequate manpower and equipment in the form of buckets, buggies, chutes, conveyors or other approved means to assure continuous operation.
3. Convey concrete so that no equipment with aluminum parts comes in contact with fresh concrete.

H. Concrete Placement: Do not place concrete until subgrade and forms have been checked for line and grade. Moisten granular base course as required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they have been brought to the required finish grade, alignment, and expansion joints have been installed.

I. Spread concrete as soon as it is deposited on the granular base course, using methods which prevent segregation of the mix, and with as little rehandling as possible. Consolidate concrete along the face of forms. Consolidate with care to prevent dislocation of mesh, reinforcing and joint materials.

J. Install Concrete Walk Joints:

1. Construct expansion and contraction joints as detailed and as shown on plans. Concrete joints that do not follow the pattern(s) shown on the plans and/or changes that have been approved by the Architect will be removed and replaced at no additional cost to the Owner.
2. When the walkway is abutting existing walks, place transverse joints to align with previously placed joints, unless otherwise shown.
3. Contraction Joints: Approximately 5' on center. Break walk into individual slabs of not more than twenty-five (25 sf) square feet with jointing tool, round edges. Saw cut scoring pattern (contraction joints) to depth shown on details for each type of concrete work with new, sharp concrete sawblade one day (24 hours) after the pour. Joint cuts to be clean, sharp, uniformly made cuts to achieve scoring pattern as shown and detailed. Note: When tooled joints or saw cutting is not performed as described, an extended three (3 yr.) year written guarantee or credit for defective work

will be required as determined by the Architect at no additional cost to the Owner.

4. Expansion Joints: Provide where abutting building(s), columns, structures, concrete paving and curbs, catch basins, manholes, inlets, walks, walls, other fixed objects and as directed by the Architect.
5. Locate expansion joints at thirty feet on center (30' o.c.) for each walkway lane, unless otherwise shown. Provide slip dowels as detailed and specified.
6. Locate expansion joints with slip dowels at all flush building access points, whether specifically shown on drawings or not.
7. Extend joint fillers full width and depth of the joint, flush with finished pavement grade, and not less than 1/4" or more than 1/2" below the finished pavement surface. Joint surfaces shall be clean and dry prior to installation of sealant as per manufacturer's recommendations. Remove excess sealant on surfaces adjacent to joint.

K. Concrete Finishing:

1. Perform concrete finishing using machine or hand methods as required.
2. After striking off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
3. After floating, test surface for trueness with a ten (10') foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous, smooth finish.
4. Work edges of slabs and joints with a 1/8" radius edging tool, two (2") wide, unless otherwise shown.
5. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows.
6. Broom finish, by drawing a medium hair broom across the concrete surface as detailed. Repeat operation when required to provide a medium texture acceptable to the Architect.
7. For handicap curb ramps, tool grooves along sloping surfaces in line with drainage flow as detailed.
8. Curing: Refer to schedule noted in 1.6, above.

    a. Immediately after placement, protect concrete form premature drying.
    b. Remove all dirt, dust, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry.
    c. Stir curing compound thoroughly before using.
    d. Apply a continuous, uniform film by solvent-resistant low pressure spray only, short-nap roller or lamb's wool applicator. For best results, use a canister curing compound sprayer. Use spray tip number 8004 or equivalent for water-based or waterborne products.
    e. For curing, apply first coat evenly and uniformly as soon as possible after final finishing. Apply second coat when all construction is completed and structure is ready for occupancy.

f. When soil contamination occurs, notify the Architect immediately in writing. Remove contaminated soils and legally dispose of, provide soil test(s), replace soil, plantings and lawns at no additional cost to the Owner.

L. Detectable Warning System:

1. Pour and float concrete, set tile by tamping grid pattern down into the concrete until all air voids are removed with a rubber mallet.
2. Place two cinder blocks or 25 lbs weights on the tile to prevent floating.
3. Create an edge around the perimeter of the tile using a 3/8" radius edging tool then float the concrete around the tile's perimeter using a steel trowel.
4. After concrete has cured, remove protective plastic wrap.
5. Protect tiles against damage during construction and clean tiles as recommended by the manufacturer.

3.2 CONCRETE CURB and GUTTER

A. General: Concrete Curb and Gutter shall meet the requirements specified for concrete in this Section, Item 3.1 above. Install forms true to line and grades given on plan. Provide permanent in place expansion joints using pre-molded expansion joint filler thirty feet (30' o.c.) on center, maximum. Install reinforcing bars as detailed. Remove forms in twenty-four (24) hours. Saw cut the contraction joints approximately 10' on center 1-1/2" deep with a new sharp concrete saw blade the next day after the pour along top and both faces of curb. Note: When the sawcutting is not performed as described, an extended written guarantee or credit for defective work will be required by the Architect.

B. Finishing: Remove ties and patch tie holes, including those below grade. Remove fins and patch minor voids. Chip out major stone pockets and repair. Rub surface smooth with carborundum brick dipped in neat cement grout to fill pin holes. Trowelled on cement plaster is prohibited. After drying, rub off excess cement dust with burlap.

C. Curing: See 3.1, above.

D. Slip-formed (machine formed) curb and gutters are acceptable when installed in accordance with NYSDOT 609-3.04-B using Type "J" concrete and mixing in fiber mesh as specified. Expansion and contraction joints are still required as detailed including slip dowels at expansion joints.

3.3 FOOTINGS, BASES, FOUNDATIONS

A. Footings, Bases, Foundations: Locate and provide where shown on drawings and as detailed.

3.4 INTERRUPTION OF CONCRETING

A. Should placing concrete be suspended or unavoidably interrupted, provide key ways and bulkheads to prevent feather-edging when work is resumed. Roughen horizontal surface for bond.

3.5 REPAIR AND PROTECTION FOR CONCRETE WORK

A. Cut out and replace defective concrete work which has blisters, cracking, crazing, curling, discoloration, dusting, efflorescence, low spots, pop outs, scaling or mortar
flaking, spalling, settling, or heaving as defined by Portland Cement Association 2001, "Concrete Slab Surface Defects" and as directed by the Architect.

B. Modify or replace concrete not conforming to the required lines, details, elevations and specifications as directed by the Architect.

C. Protect the work from damage until acceptance of the work. Exclude traffic from concrete work for at least fourteen (14) days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.

3.6 ANCHORING RAILINGS AND POSTS INTO CONCRETE

A. Aluminum posts **must** be coated or treated with a good sealer or paint prior to anchoring.

B. Drill the hole as detailed. Blow out all dust and loose particles.

C. Fill the hole with water. Scrub the sides and bottom of the hole and with a stiff wire brush such as a bottlebrush. This is important.

D. Remove excess water with rag or other absorbent materials. Leave the hole clean and uniformly damp.

E. Mix the anchoring cement in a clean container to flowable consistency based on the following formula. For best results, measure accurately. The correct amount of water is as follows:

2.3 oz per lb
11.5 oz for 5 lbs
115 oz for 50 lbs
7 quarts for 100 lbs

Measure the amount of anchoring cement and water to be mixed. Add the measured amount of water to the appropriate amount of cement and mix until the desired consistency is achieved. (NEVER USE MORE WATER THAN PRESCRIBED). This will reduce the ultimate strength, increase the possibility of volume instability and may cause the product to become soft and less durable.)

F. Fill the hole with the plastic cement first, and then tamp the bolt, post or rod with a twisting motion into place. If the material becomes too fluid during the tamping process and sags out of place, let it stand for a few minutes and it will stiffen. Smooth out the surface around the bolt with spatula or trowel.

G. Let the cement harden for at least 60 minutes. For heavy equipment, allow 4 hours prior to use or loading.

3.7 ANCHORING BOLTS, DOWELS, AND REBAR INTO CONCRETE

A. Anchor Hole Preparation: Prepare all anchor holes prior to placement of anchoring epoxy. Hole diameter is typically 1/8" (3 mm) greater than the anchor diameter. Hole depth is typically nine times anchor diameter. Required minimum anchor hole depth is 6". Consult project specifications and details. Drill hole to proper diameter and depth and blow all dust from the bottom of the hole, brush and blow (4x) repeatedly to remove all dust and debris. The anchor hole must be clean and free of standing water prior to placement of material.

B. Application: Use only professional caulking gun. Remove plastic cap and plugs from cartridge. Save for closing cartridge. Attach mixing nozzle to cartridge. Discard small amount of gunned product until uniform color is achieved. Mixing nozzle will harden in approximately 20 min. if not in use.

C. Hardened nozzle must be discarded. Dispense the epoxy at the bottom of the hole while withdrawing nozzle. Dispense epoxy (typically filling 5/8 of hole) so that once threaded rod or rebar is inserted, the hole is completely full. Insert threaded rod or rebar to the bottom of the hole while turning clockwise. Promptly remove any excess material. Leave anchor undisturbed for 6 hours (at 77°F /25°C), or longer for colder temperatures. Load can be applied 8 hours at 77°F (25°C).

3.8 CONCRETE BONDING AGENT

A. Required at elements where new concrete is applied and joined to existing concrete.

B. Surface Preparation:

1. Apply only to clean, sound, dry surfaces.
2. Remove dust, dirt, oil, grease, wax, unsound concrete and plaster, paint, and other foreign materials.

C. Applications:

1. Apply to a dry surface with brush, roller or spray to the thickness of a coat of paint.
2. Place new concrete, topping mixes, Portland cement, or patches as soon as the adhesive is dry.
3. Make sure basecoat is dry before applying adhesive.
4. Tools, brushes and other application accessories should be immediately cleaned with soapy water. Use hot water to clean up any drippings.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed by ACI certified technicians; Grade 1. Certificates shall be submitted to the Architect for persons performing inspection and testing prior to the start of work.

B. Field Inspection and testing shall be paid for as directed under 1.5 "Quality Assurance". Where retesting, additional inspection, lab tests or other professional

services are required due to rejected work, any cost associated therewith will be solely at the Contractor's expense.

C. The Contractor shall plan his operations to allow adequate time for all required testing and inspection.

D. The Contractor shall provide facilities and equipment necessary to obtain and handle representative sample of materials to be tested.

E. The testing laboratory shall be responsible to the Owner for the field control of all concrete and may reject batches because of high slump, uncontrolled air entrainment, delays or other conditions of non-compliance with these specifications.

F. Sampling and Field testing will be performed during concrete placement per ASTM C31, C39, C143, C172 and C173.

G. Five (5) Concrete Test Cylinders: Taken for every 30 or less cubic yards of concrete placed are required or a fraction thereof;

1. Two (2) Cylinders will be tested at 7 days, two (2) cylinders will be tested at 28 days and one (1) cylinder will be held for possible testing at a later time.

H. One (1) Additional Test Cylinder: Taken during cold weather concreting, to be cured on the job site under the same conditions as placed concrete it represents, is required.

I. Air Content Test: Taken for each set of test cylinders taken, is required.

H. One (1) Slump Test: Taken for each set of test cylinders taken is required.

K. Test results will be reported by telephone to the General Contractor and Architect on same day tests are made. Written report with copies will follow to the Owner, Architect, and Landscape Architect. Email copies of laboratory test, evaluation reports for concrete materials and mix designs will be submitted.

3.10 CLEAN UP

During the contract and at intervals as directed by the Architect and as concrete work is completed, clear the site of gravel, concrete, appurtenances and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION

SECTION 329001 - PLANTING

PART 1. GENERAL

1.1. DESCRIPTION OF WORK:

A. The extent of planting is shown on the drawings.

B. Planting work includes, but is not limited to, the following:

1. Soil preparation
2. Planting commercially grown trees, shrubs, perennials and ground covers.
3. Planting accessories
4. Maintenance: See watering, weed control and other specific requirements
5. Guarantee
6. Clean up

C. The Contractor shall provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2. RELATED WORK SPECIFIED ELSEWHERE:

A. Section 312201 - Site Earthwork

B. Section 329201 - Lawns

1.3. SUBMITTALS: (See Section 311201, 1.5)

A. Furnish name of Landscape Contractor and/or Nurseryman to perform planting work and obtain Architect's approval.

B. Provide Material Certificates, MPD, Test Reports or Samples as noted for:

1. Mulch: Twelve (12 oz.) ounce sample
2. Planting Soil Mixture: Material Certificate and Test Report. See 1.4 F.
3. Plant Materials: Certificates of Inspection by regulatory agencies. Leave tags with botanical names and nursery source(s) on plants until reviewed by Architect.

1.4. QUALITY ASSURANCE:

A. Perform planting in compliance with applicable requirements of governing authorities having jurisdiction.

B. Planting Contractor: Planting work by established Landscape Contractor and/or Nurseryman having sufficiently experienced crews, supervisor(s), specialized equipment and an excellent record of performance on completed planting projects of comparable size, scope, and quality. Provide expert plantsman to direct the work in the field on a regular, daily basis.

C. Nomenclature: Plant names shall conform to the latest edition of "Standardized Plant Names" as adopted by the American Joint Committee of Horticultural Nomenclature. Plants shall be true to botanical name, tagged with a waterproof, legible tag showing botanical name, size, and nursery source of origin.

D. Size and Grading: Plant sizes and grading shall conform to the latest edition of "American Standard for Nursery Stock" as sponsored by the American Association of Nurserymen, Incorporated (AAN), latest issue unless otherwise specified.

E. Nursery Source: Obtain freshly dug, healthy, vigorous, plants nursery grown under climatic conditions similar to those in the locality of the project for a minimum of two (2) years. Plants shall have been lined out in rows, annually cultivated, sprayed, pruned, and fertilized in accordance with good horticultural practice. Plants shall have been transplanted or root pruned at least once in the past three years. Balled and burlapped plants must come from soil which will hold a firm root ball. Heeled in plants and plants from cold storage not accepted.

F. Testing:

1. Engage an independent, qualified State of New York soil testing service. Pay for soil testing and inspection services.
2. Test representative material samples proposed for use as follows:

a. Planting Soil Mixture
   (1) pH factor
   (2) Mechanical analysis
   (3) Percentage of organic content
   (4) Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

b. Peat Moss
   (1) Loss of weight by ignition
   (2) Moisture absorption capacity

1.5: JOB CONDITIONS:

A. Job conditions in Section 312201 apply.

B. Planting seasons and timing conditions:

1. Unless otherwise directed in writing by the Architect, the planting of trees, shrubs, and perennials shall be from in the Spring, March 15 to June 1, and in the Fall, from October 15 to December 15. Refer to 1.5 Fall Planting Hazard restrictions below.
2. Proceed with and complete planting work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
3. Do not conduct planting operations until fine grading in the work areas has been completed satisfactorily.
4. Cooperate with other Contractors and trades working in and adjacent to planting locations. Examine drawings and specifications for the entire site and become familiar with the scope of other work required, especially underground utilities.

C. Construction Review:

1. Plants must be reviewed by the Architect before planting, either at the site or at the nursery.

2. Notify the Architect forty-eight (48) hours prior to delivery of plant materials to the site.
3. Plants not meeting specifications or not installed according to drawings may be rejected at any time by the Architect.

D. Provide plants of the species, size, and special characteristics noted on the Plant List. Substitutions not permitted unless approved in writing by the Architect. In the event that quantity discrepancies or material omissions occur in the Plant List, the planting drawings shall govern.

E. Contractor shall provide labor, water (including trucking), hoses, sprinklers and watering equipment.

F. Fall Planting Hazard (FPH):

1. Notify the Architect in writing when any of the proposed plants are sensitive to fall planting in the experience of the Contractor. Plant materials noted as FPH in the PLANT LIST shall be planted in the Spring season. Assume sole responsibility of plant health related to materials noted FPH which are fall planted. Replace unhealthy or dead plants as described in the Guarantee.
2. Plants considered very risky to transplant in the fall include, but are not limited to, the following; (based on information obtained from Princeton Nurseries, Fall 2001- Spring 2002 catalog and experience of the Landscape Architect)

Acer rubrum & vars.	Platanus acerifolia
Betula varieties	Prunus - Stone fruits
Carpinus varieties	Pyrus - Pears
Cornus florida & vars.	Quercus - Oaks
Crataegus varieties	Salix - weeping vars.
Halesia	Strax japonica
Koelreuteria	Tilia tomentosa
Liquidambar styraciflua	Zelkova varieties
Liriodendron tulipifera	Pinus nigra

3. Evergreen plant materials are also considered a fall planting hazard.

PART 2. PRODUCTS

2.1. PLANTS:

A. Plants shall be well formed without voids and open spaces, typical of their species or variety, with normal habit of growth. Plants shall be first quality, sound, healthy, vigorous, well branched and densely foliated. Plants shall have healthy, well developed fibrous root systems. They shall be free of defects, disfiguring knots, sun-scald injuries, frost cracks, abrasions, disease, insect pests, eggs, and larvae.

B. Plants shall conform to the measurements specified in the Plant List. Measurements specified shall be minimum size acceptable for each variety. For each plant of minimum size, provide a plant of maximum size. Plants that meet the requirements specified in the Plant List, but do not possess a normal balance between height and spread will not be accepted. Plants for use when symmetry is required, or in rows, shall be matched as nearly as possible. Plants shall not be pruned prior to delivery.

C. Plants and tree trunks shall be measured when the branches are in their normal position. Dimensions for height and spread as contained herein refer to the main body of the plant and not from branch-tip to branch-tip. Shade trees shall be free of branches up to seven feet, with a single leader, well branched and reasonably straight stems. No trees which have had their leaders cut or damaged will be accepted. Trees must have straight trunks with single leader intact. There shall be no abrasion of the bark and no fresh cuts of limbs over one (1") inch which has not been completely calloused over.

D. Balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock." Cracked or mushroomed balls are not acceptable.

E. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

1. No plants shall be loose in the container.
2. Container stock shall not be pot bound.

F. Spade transplants: Shall be dug with Architect approved self propelled tree spade, Verimeer or Big John type equipment, capable of taking adequate size root ball to ensure the survival of transplants. Blades shall be sharp to ensure a clean cut of roots. Trees shall be sprayed prior to digging with an anti-desicant and foliage tied and covered to reduce excessive moisture loss.

G. Bare-root plants dug with adequate fibrous roots, covered with a uniformly thick coating of mud by being puddled immediately after they are dug, or packed in moist straw or peat moss.

H. Evergreen trees shall be fully branched to the ground. (Park Standard)

2.2. PLANTING ACCESSORIES:

A. Planting soil mixture for trees, shrubs, perennials, annuals and plant beds shall be premixed in bulk, and contain the following by volume:

20 parts clean on site soil
10 parts topsoil

B. Topsoil: 5-8% organic, 20-50% passing 200 mesh sieve. Fertile, friable, natural topsoil of leafy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sand, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 6.5 and 7.5, free of substances harmful to plants which will be grown in the soil.

C. Starter Fertilizer: Water soluble fertilizer and plant food 10-52-17 containing no sulfate or chloride salts. Standard of quality shall be as manufactured by Fairlawn Chemical Co., Inc., 485 Holt Road, Webster, NY (585) 671-2400, and distributed by Organix, 569 Klem Road, Webster, NY (585) 787-2711 or Architect approved equal.

D. Peat Moss: Brown to black in color, weed and seed free, dried sphagnum peat moss, containing not more than 9% mineral on a dry basis and conforming to NYSDOT 713-20.

E. Stakes: Minimum eight (8') foot long, two (2") inch round or square sound wood stakes.

F. Hose: New, two (2) ply garden hose not less than one-half (1/2") inch in diameter.

G. Guy Wire: 10 gauge galvanized steel wire for guying plantings where specified.

H. Tree Wrap: Standard of quality shall be four (4") inch wide waterproof 30-30-30 Krinklecraft, or Architect approved equal.

I. Mulch: Ground or shredded bark, medium size, from softwood trees. No pieces over two (2") inches in greatest dimension. Free from sawdust, stones, debris, and deleterious materials.

J. Anti-desiccant: Standard of quality shall be "Wiltpruf" or Architect approved equal.

PART 3. EXECUTION

3.1. LAYOUT: Locate and stake in the field individual trees, shrubs, and plant beds for approval by the Architect prior to commencing planting operations.

3.2. GENERAL PLANTING OPERATIONS:

A. Transportation and Handling: Take precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Spray deciduous plants to foliage with an approved "Anti-Desiccant" immediately after digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury. Do not hold or move trees by stems. Support and protect root balls.

B. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Architect.

C. Protect plants from drying out. When plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Architect. Water heeled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches. Cover plants transported on open vehicles with protective covering to prevent wind burn. Do not hold or move trees by stems. Support and protect root balls.

D. Provide dry, loose prepared planting soil for planting bed mixes. Frozen or muddy soil is not acceptable.

E. Excavate tree pits, shrub and planting beds as dimensioned and located on drawings. When soils harmful to plant materials are encountered, immediately notify the Architect.

F. Plants shall be set plumb and straight and at such a level that after settlement, a normal or natural relationship of the crown of the plant with the ground surface will be established. Each plant shall be planted in the center of the pit. When balled, burlapped, and platformed plants are set, the platform shall first be removed from the pit and topsoil shall be carefully tamped under and around the base of each ball to

fill voids. Burlap, ropes, and wires shall be removed from the sides and tops of balls, but no burlap shall be pulled out from under the balls.

G. Plants shall be planted in the planting soil mixture which shall be thoroughly watered and tamped. On level ground or slight slopes, a shallow basin a little larger than the diameter of the plant pit shall be left around each plant as shown on the drawings or as directed by the Architect. On steep slopes, the soil on the lower side of the plant shall be graded in such a manner that it will catch and hold water as shown on the drawings or as directed by the Architect.

H. Staking: Trees two (2") inch caliper or less shall be staked with two stakes. The trunks of trees larger than two (2") inches shall be staked with three stakes, equally spaced about the tree, set vertically and securely fastened. The trees shall be guyed with two or three strands of wire as specified, which shall run through the rubber hose and be securely tightened.

I. Install weed control fabric over the planting area to limits indicated or as directed by the Architect. Cut fabric as required to avoid shrubs.

J. Mulching: Spread continuous four (4") inches settled depth of mulch over finished surface of each plant, plant bed, or hedge trench as detailed. Water plants thoroughly after mulching. NOTE: The Architect may field check depth of mulch for proper weed control barrier since no weed control fabric is required.

K. Wrap deciduous trees with tree wrap to first branch and secure wrap.

L. Pruning: Each shrub or tree shall be pruned to preserve the natural character of the plant. Remove dead wood and crossing branches. Do not prune terminal leaders. Refer to drawings for additional tree pruning details.

M. Anti-Desiccant: Immediately after planting and staking, trees and shrubs shall be sprayed with anti-desiccant, using an approved power sprayer to apply an adequate film over trunks, branches, twigs, and/or foliage. Apply according to manufacturer's recommendations.

N. Replacements: Remove and immediately replace plants, as determined by the Architect, to be unsatisfactory during the initial planting installation.

3.3. PLANT PERENNIALS: Rototill entire bed prior to planting. Rake surface smooth and remove stones one (1") inch and greater. Remove plants from pots or flats and plant immediately in prepared planting soil. Water thoroughly. Place four (4") inches continuous settled depth mulch over entire bed.

3.4. INSTALL EDGE: When shown on drawings according to manufacturer's recommendations.

3.5. MAINTENANCE:

A. Maintenance by Contractor begins as soon as plants are installed. Protect plants from drought, washout and wind erosion. In general, maintain new plantings, including watering, weeding, pruning, applications of herbicides, fungicides, insecticides and pesticides, until healthy, vigorous plants are accepted by the Architect. Specifically:

1. Protect: Protect plantings against harsh weather, trespass and vandalism by wrapping, staking, temporary fencing or other means.
2. Water: The Contractor shall provide water **(including any trucking required)**, labor, hoses, sprinklers and watering equipment to maintain plants, prevent them from drying (browning) out, and keep plants in a healthy, growing condition until final acceptance.
3. Cultivate: Cultivate plants by straightening any settled plant materials, restaking and guying, rewrapping, pruning dead and broken branches, weeding and re-applying anti-desiccant, herbicide, fungicide, insecticide and pesticide.
4. Should the Contractor fail to protect and maintain the plantings, the Owner may issue a three (3) day notification to the Contractor, hire work done, and backcharge this Contractor.

B. Maintenance by the Contractor continues until Certificate of Final Acceptance, or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later. Maintenance by Owner begins as soon as the Architect issues Certificate of Final Acceptance or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later.

3.6. STANDARDS FOR ACCEPTANCE: Review to determine acceptance of plantings will be made by the Architect upon request. Provide notification at least five (5) working days before requested review date.

A. New plantings will be acceptable provided requirements, including maintenance, have been complied with. Healthy, well-formed, vigorous plants, true to species and size on Plant List, must be established, free of disease, broken branches and insects.

B. Any plant which is poorly formed, structurally unsound, not true to species and size on Plant List, diseased, contains broken branches, or is generally unhealthy (containing 25% or more browned out foliage), shall be rejected and replanted at no additional cost to the Owner.

3.7. GUARANTEE:

A. Contractor shall guarantee plant materials to be true to species and size on Plant List, and in vigorous growing condition, for a period of one (1 yr.) year from the date given on the Certificate of Substantial Completion or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later.

B. Any plant material that does not meet the Standards for Acceptance shall be replaced as soon as weather conditions permit. Replacement plantings shall be made in accordance with the specifications and drawings. Replacements shall be subject to inspection, acceptance, and guaranteed for one (1 yr.) year after date of replanting and acceptance by the Architect.

3.8. CLEAN UP:

During the contract and at intervals as directed by the Architect and as planting is completed, clear the site of extraneous materials, pots, flats, hose, wire, stakes, pruned branches, rubbish, and debris. Leave the site in a clean, safe, neat, well draining condition.

END OF SECTION

SECTION 329201 - SODDED LAWNS

PART 1. GENERAL

1.1. DESCRIPTION OF WORK:

A. The extent of the lawn work is shown on the drawings. The lawn work limits equal the Contract Limit Line except as noted on the drawings. Non-paved, non-roofed areas within the Contract Limit Line shall receive four (4") inches settled depth of topsoil and sod. Existing lawn areas that are not disturbed require no additional work. Lawn types as shown on the drawings are defined as follows:

1. Lawn Type 1: Strip and stockpile topsoil, replace 4" topsoil, and sod.

B. Lawn work includes, but is not limited to, the following:

1. Placing and spreading stockpiled topsoil
2. Importing, placing and spreading topsoil
3. Sod bed preparation and placing
4. Seed bed preparation
5. Seeding and sodding lawns
6. Mulching and fertilizing
7. Maintenance: See watering (including trucking), mowing, fertilizing, core aerating, weed control, grow in and other specific requirements.
8. Clean Up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2. RELATED WORK SPECIFIED ELSEWHERE:

A. Section 311201 - Site Preparation (Topsoil Stripping)

B. Section 312201 - Site Earthwork

1.3. REFERENCES:

A. ASTM D4972 - Standard Test Method for pH of Soils

B. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping Purposes

C. ASTM D422 and D1140 - Standard Test Method for Particle Size Analysis of Soils

D. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effect

E. ASTM F1647 - Standard Test Method for Organic Material Content of Athletic Field Rootzone Mixes.

F. ASTM F1632 - Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sportsfield Rootzone Mixes

G. ASTM F2060 - Standard Guide for Maintaining Cool Season Turfgrasses on Athletic Fields

H. National Turfgrass Federation, Inc.

I. National Turfgrass Evaluation Program (NTEP).

J. Cornell Universities: Sportsfield Management Guidelines

K. Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.

1.4. SUBMITTALS: (See Section 311201, 1.5)

A. Furnish name of Landscape Contractor or Nurseryman to perform lawn work and a list of completed projects including contact information for each project demonstrating compliance with applicable qualification requirements outlined in 1.5 "Quality Assurance" of this specification section.

B. Provide Material Certificates and MPD for:

1. Sod species and source, location for sod producer
2. Limestone
3. Fertilizers

C. Provide Topsoil Test Report (for Onsite and Imported Topsoil): Submit test results from Architect approved independent testing laboratory on their letterhead. Report shall:

1. Certify soil texture, organic content, and particle size analysis.
2. Chemical analysis testing nitrogen, phosphorus, potassium, calcium, magnesium, cation exchange capacity, base saturation percentages, micronutrients and acidity (pH).
3. Provide timing and rates of soil additives, liming and fertilizers. (Materials and procedures regarding soil amendments and fertilizers specified in this section are approximate.) Adjust all soil amendments to comply with test results based on actual soil tests and as directed by the Architect at no additional cost to the Owner.

D. Provide letter on Contractor's letterhead certifying that only topsoil from the above tested source was used on the project.

1.5. QUALITY ASSURANCE:

A. General and Lawn Contractor: Work shall be contracted to a single, established Landscape Contracting or Nursery firm having sufficiently experienced crews, supervisor(s), specialized equipment, and an excellent record of performance on completed lawn and athletic field projects of comparable size, scope, and quality. Provide expert turfman to direct the work in the field on a regular, daily basis. The expert turfman shall be employed by the same company engaged in the installation of the lawn and athletic field work for a minimum of five (5) years.

B. Sod Standards: Comply with the Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.

C. Nomenclature: Seed names shall conform to the National Turfgrass Federation, Inc.

D. Seed Quality Rating: Shall meet testing standard for New York State outlined by the National Turfgrass Evaluation Program (NTEP).

E. Testing: If required by the Architect for poor lawn grow in, engage an Architect approved independent, qualified New York State testing service and turfgrass specialist to evaluate Contractor grow in practices and materials used. Pay for all testing/inspection services, materials, and manpower to correct lawn areas as approved by the Architect.

1.6. DELIVERY, STORAGE, AND HANDLING:

A. Sod:

1. Cut, deliver, and install sod within a 24-hour period. Sod cutting and shipping shall be coordinated with the sod installers.
2. Do not harvest or transport sod when moisture content may adversely affect sod survival.
3. Protect sod from sun, wind, and dehydration prior to installation.
4. Do not tear, stretch or drop sod during handling and installation.
5. Store sod materials at site in an orderly manner at location(s) acceptable to the Architect.

B. Fertilizer:

1. Deliver fertilizer in the manufacturer's standard sized bags showing the weight, analysis, and manufacturer's name. Store all fertilizer under a waterproof cover or in a dry place as approved by the Architect.

1.7. JOB CONDITIONS:

A. Job conditions in Section 312201 apply.

B. Lawn Work:

1. Perform lawn work after planting, fine grading and other work affecting the ground surfaces in the lawn work areas has been completed satisfactorily.
2. Where practical, the Owner will provide a connection to the water system such as, but not limited to, existing yard hydrants, building hose bibs, etc. If this source is insufficient, not available or practical to provide a source of sufficient water to meet the requirements herein, the Contractor shall secure a water source sufficient to meet the water requirements herein such as, but not limited to, municipal hydrants, water truck, etc. at no additional cost to the Owner.

3. Contractor shall provide all watering equipment and appurtenances such as, but not limited to, meters, backflow preventer, labor, hoses, sprinklers, irrigation and watering equipment. The Owner will pay for the water usage.
4. Calendar dates for seeding and sodding under "Sequence and Scheduling" of this specification section shall apply.
5. Place sod only when ground surface is free of mud, frost, snow and ice.

6. Protect newly sodded lawns from vehicles, vandalism, or trespass. Provide temporary fencing or barriers as required.

C. Construction Review:

1. Upon completion of topsoil spreading and sod and/or seed bed preparation, notify Architect to review work.
2. The Architect may review fine graded areas by the Contractor to check for surface smoothness and general compliance with grading requirements. Fill or cut by hand raking or other acceptable means to achieve smooth, even well-draining lawn surfaces free of "bird baths" and breaks in grade as directed by the Architect at no additional expense to the Owner.
3. On athletic fields the Architect shall review planarity of the field by string grading and/or by visual inspection of the temporary line markings installed by the Contractor prior to seeding/sodding as indicated in Part 3 - Execution.
4. Review of any fine graded lawn and athletic field areas by Architect shall not alleviate the Contractor of his responsibility for conforming to the required grades as shown on the drawings, nor be misconstrued as final acceptance of lawn work.

1.8: SEQUENCING AND SCHEDULING:

A. Schedule: Prior to construction, provide a schedule which addresses the following lawn thresholds involving erosion control stabilization and competitive use of playfields:

1. Sodding Installation: The Contractor may invoice for 50% of the approved schedule of value breakdown at the time of acceptable installation.

a. Unless otherwise directed in writing by the Architect, seed and sod lawns from April 1 to May 15, and from August 15 to October 1. Seeding and sodding between May 16 and August 14 is not acceptable unless adequate water supply is available and applied to the turfgrass as required herein and approved by the Architect.
b. Proceed with and complete seeding and sodding as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.

2. Substantial Completion: The Contractor may invoice for 25% of the approved schedule of value breakdown at the time of substantial completion as described in Part 3, "Standards For Substantial Completion

Of Lawns" of this specification section. At this time, the Architect may issue the Notice of Termination to satisfy the NYS DEC stabilization requirements. The date of substantial completion is anticipated approximately 60 days after lawn installation presuming all Contractor maintenance operations have been vigorously performed.

3. Final Acceptance: The Contractor may invoice for the final 25% of the approved schedule of value breakdown at the time of final acceptance as described in Part 3, "Standards For Final Acceptance Of Lawns" of this specification section. The date of final acceptance is anticipated approximately 30 days after substantial completion presuming all Contractor maintenance operations have been vigorously performed.
4. Owner Maintenance: After final acceptance of the lawns, the Owner will maintain for 1 to 3 growing seasons to reach competitive maturity and beyond per ASTM F2060.

PART 2. PRODUCTS

2.1 TOPSOIL:

A. Source: Provide from off site, Architect approved source, when stripped, stockpiled and amended quantity is inadequate to provide four (4") inches settled depth of topsoil for all lawn areas at no additional cost to the Owner.

B. Texture and Content: Provide topsoil conforming to the following:

1. Soil texture and content:

a. Sandy loam topsoil, well drained homogeneous texture and of uniform grade, without the admixture of subsoil material. Topsoil shall be entirely free of dense material, hardpan, clay, stones over 3/4" in diameter, sod, or any other objectionable foreign material, including but not limited to, glass, debris, toxins, hazardous wastes and chemicals (such as atrizene or muriatic acid within the past seven (7) years) that may be injurious to humans, animals and plant materials.

b. Organic Matter: Containing not less than 5% or more than 10% organic matter in that portion of a sample passing a 1/4" sieve when determined by the wet combustion method on a sample dried at 105 degrees F.

2. pH Value: Containing a pH value within the range of 6.0 to 7.0 on that portion of the sample which passes a 1/4" sieve.
3. Soluble salt content: Not higher than 500 parts per million.
4. Sieve Analysis for general lawn work: Shall be screened or rock picked to meet the following gradation:

Sieve Designation	% Passing
3/4"	100
1/4"	97-100
No. 200	20-50 (of the 1/4" sieve)

5. Sieve Analysis for Athletic Field lawn work: Shall be mechanically screened by an onsite screening facility provided by the Contractor prior

to placing and spreading. Athletic field topsoil shall meet the above sieve requirements.

C. No lawn shall be seeded or sodded on topsoil that has been chemically treated until sufficient time has elapsed to permit dissipation of all toxic materials. The Contractor shall assume full responsibility for any loss or damage to turfgrass sod or the inability to grow a sufficient stand of grass from seed, as indicated herein, arising from improper use of chemicals or due to failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

2.3. SOD:

A. Sod shall conform to NYSDOT Item 713-14 and be approved nursery grown mineral soil sod with 60% Kentucky Bluegrass and 40% Fine Fescue blend with a minimum (4) varieties. Muck grown sod is NOT acceptable. Installation of plastic netting is NOT acceptable.

B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch and extraneous material viable and capable of growth and development when planted. Sod is considered free of weeds when less than five (5) weeds are found per one hundred (100 s.f.) square feet.

C. Thickness of Cut: Furnish sod machine cut at a uniform soil thickness of 0.60 inch at the time of cutting and of supplier's standard width, length, and thickness: uniformly 1" to 1-1/2" thick with clean cut edges. Measurement of thickness shall exclude top growth and thatch. Mow sod before stripping.

D. Mowing Height: Before stripping, sod shall be mowed uniformly at a height of 1 to 1-1/2 inches.

E. Thatch: Sod shall be relatively free of thatch, up to 1/2 inch allowable (un-compressed).

F. Pad Size:

1. For General Lawn: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 inch on width and plus or minus 5% on length. Broken pads and torn or uneven ends will not be acceptable.
2. For Athletic Fields and Other Such Large Areas: Sod shall be thick-cut "big" rolls of 250 s.f. Maximum allowable deviation from standard width and lengths shall be plus or minus 1/8" on width and plus or minus 1/2% on length. Broken and torn or uneven rolls will not be acceptable.

G. 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.

H. Standard of Quality: Shall be Premium Sod supplied by Batavia Turf (800) 333-1472, Sky High Turf Farms (315) 687-6510, Saratoga Sod Farm (518) 664-5038, Lakeside Sod (716) 741-2877 or Architect approved equal.

2.4. LIMESTONE:

A. Shall be ground limestone in the producer's standard bags containing not less than 85% total carbonates and conforming to the following gradations:

Sieve Designation	% Passing
No. 100	50-100
No. 20	100

B. The lime shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use will be rejected.

2.5. FERTILIZER:

A. For Starter Fertilization: Immediately prior to seeding, fertilize with a commercial starter fertilizer, granular, non-burning product, with not less than 90% organic slow acting, micro nutrients and 1% iron, guaranteed analysis commercial fertilizer. Fertilizer ratio shall be: (1-2-1). Apply at a rate of 0.33 - 0.66 lbs of nitrogen (N) per 1,000 sf.

B. For Subsequent and Final Fertilizations: Apply commercial fertilizer, poly coated granular non-burning product with not less than 90% organic slow acting, guaranteed analysis

1. For Spring and Fall Lawn Work: Fertilizer ratio shall be: (3-0-1). Apply at rate of 1.5 - 2 lbs nitrogen (N)/1,000 s.f.

2.6. WATER: Free of substance harmful to lawn, other plants, humans and animals.

PART 3. EXECUTION

3.1. INSPECTION:

A. Verify limits of lawn and other types of ground cover materials in the field with drawings. Also any imported and screened topsoil areas. Notify Architect of discrepancies prior to proceeding with lawn work.

B. Examine finish surfaces, grade, topsoil quality, and depth.

C. Do not start lawn work until unsatisfactory conditions are corrected to the satisfaction of the Architect.

3.2. SPREAD TOPSOIL:

A. Limit preparation to areas which will be immediately sodded.

B. Perform topsoil spreading operations only during dry weather.

C. To insure a proper bond with the topsoil, disc, harrow, or otherwise scarify and loosen the lawn subgrade to a depth of four (4") inches before spreading topsoil.

D. Spread topsoil to ensure a minimum settled depth of four (4") or six (6") inches in lawn areas.

3.3. PREPARE GENERAL LAWN AREAS TYPE 1:

A. Perform a pH test, sieve, and nutrient analysis of the topsoil and advise the results to the Architect prior to adding limestone or other soil amendments. Soil amendments shall be uniformly incorporated into the top four (4") or six (6") inches of topsoil by discing, harrowing or other approved methods.

B. Remove debris and stones 3/4" or larger by handpicking, fine tooth aluminum grading rakes, and mechanized stone picker. When topsoil has hardened, cultivate soil to a four (4") or six (6") inch depth by plowing, discing, harrowing, or otherwise scarifying and loosening the topsoil.

C. Grade lawn areas to a smooth, free draining even surface with a loose, moderately coarse texture. Scarify, rake, level, and roll with a light static roller as necessary to obtain true, even lawn surfaces and fill depressions as required to drain. Correct irregularities in the surface resulting from tillage operations to prevent formation of depressions or water pockets.

D. Cultivate soil to provide a firm bed of minimum of four (4") inches deep, free of clods, stones, or foreign matter over 3/4" in diameter from the top of soil. Do not move heavy objects except necessary lawn making equipment over the lawn areas after the soil is prepared unless it is again loosened and graded. Remove stones and all debris greater than one 3/4" in diameter during cultivation. Level undulations and irregularities in the surface.

E. For pH correction provide adjusted rate of application as recommended in Topsoil Test Report submittal. For low pH correction: Add ground limestone at the rate indicated by the soil test. For high pH correction: Materials and application rates shall be determined by appropriate soil tests.

F. Place starter fertilizer at the rate of 0.33 - 0.66 lbs. of nitrogen (N) per 1,000 sf. and mix into full depth of topsoil.

G. Rake area with fine toothed aluminum grading rake before placing seed to obtain a smooth surface at the proper elevation. Drag area with a wood float to level out minor humps and hollows. Beds shall have a smooth friable uniform surface, free of areas ponding water.

3.4. SODDING:

A. Notify Architect that sod bed is ready for review as specified in Job Conditions. Obtain Architect's approval prior to sodding.

B. Moistening the Soil: During periods of higher than optimal temperature for species being specified and after unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to laying the sod.

C. Sod immediately after preparation of bed and Architect's approval.

D. Lay sod to form a solid mass with tightly-fitted joints in strips parallel to contours. Butt ends and sides of sod strips. Do not overlap edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with finish grade of adjacent curbs, pavements, drainage structures and seeded areas.

E. Do not lay dormant sod or install sod on soil surfaces that are hot, dry, saturated or frozen.

F. When sodding slopes, install initial row of sod in a straight line, beginning at bottom of slope. Place subsequent rows parallel to and lightly against previously installed row.

G. Sod strips laid in drainageways must meet the finished grades shown on the drawings.

H. Sod abutting existing lawn or seeded lawns shall meet flush with top of sod pad (soil and thatch). Remove excess topsoil as necessary to meet flush.

I. Stake sod in lawn swales and on lawn slopes 3H to 1V (horizontal to vertical) and steeper to prevent slippage. Use two (2) biodegradable stakes per square yard of sod. Stakes are to have their flat sides against the slope and be driven flush with sod surface.

J. Roll with light static lawn roller to ensure contact with subgrade.

K. As sodding is completed in anyone section, water sod thoroughly to a depth sufficient to ensure the underside of the new sod pad and topsoil immediately below the pad is thoroughly wet. Contractor is responsible to ensure there is an adequate water supply available prior to installation. Do not allow sod to dry out.

3.5. MAINTENANCE:

A. Maintenance by Contractor begins as soon as lawns are sodded or seeded. Protect lawns from drought, washout and wind erosion. In general, maintain new installed lawn areas, including watering (including trucking of water supply), fertilizing, core aerating, spot weeding, overseeding, mowing, applications of herbicides, fungicides, insecticides, and re-sodding until a full, uniform, healthy, vigorous stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Architect. Specifically:

1. Watering Sodded Lawns **(Includes Trucking of Water Supply)**:

   a. First Week: Soil on sod pads shall be kept moist. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least four (4") inches.

2. Second and Subsequent Weeks: Contractor shall provide water to the lawns as required to maintain adequate moisture, in the upper four (4") inches of soil, necessary for the promotion of deep root growth until final acceptance. After 2nd mowing, water two (2) times weekly until thoroughly established.
3. Protect: Protect lawn areas against trespass, vandalism and routine pedestrian traffic and Owner maintenance traffic by temporary fencing or other means acceptable to the Owner.
4. Repair: Repair, rework, resod and overseed (as originally specified for that area) areas that have washed out, eroded, do not germinate and are vandalized or otherwise damaged. Overseeding rates are to be adjusted to 6 lbs. of seed per 1,000 s.f.
5. Mow: Initial mowing shall begin when the blade height reaches 2" and the soil will bear the weight of the lawn mower. Use mowers with low impact tires. For the first 3 mowings cut the grass blades to 1.5 inches. After that mow the grass when it reaches a height of about 3.5" to a height of about 2.5". Never remove more than 1/3 of the grass blade at any one mowing. A minimum of eight (8) to ten (10) mowings are required (approximately once per week after the initial germination period to final acceptance). Notify the Architect of dates in writing as mowing is performed. Excess clippings shall be carefully raked so as not to remove healthy grasses, and removed.
6. Core Aerating: Between mowings three (3) and four (4), and between mowings seven (7) and eight (8) core aerate lawns about three (3") inches on center minimum three (3") inches deep to ensure aggressive root growth. This will require multiple passes at different directions to achieve 16 to 20 holes 3/4" to 1" diameter per square foot. Sweep scattered plugs off paved areas onto adjacent lawn areas. Pulverize plugs during subsequent mowing operations. Provide additional core aerating after the 10th mowing as directed by the Architect to expedite the lawn maturation process. Moisten field by thoroughly watering the topsoil profile, several days in advance of coring to facilitate proper penetration of the topsoil.
7. Fertilizer: Immediately after core aerating, between mowings three (3) and four(4), and between mowing seven (7) and eight (8) apply subsequent fertilizer at the rate of 1.5-2 lbs./1,000 s.f. Provide additional fertilizer after the 10th mowing as directed by the Architect to expedite the lawn maturation process. Apply a final fertilizer just prior to final acceptance at the same application rate.
8. Weed Control: When infestation of weeds or crabgrass develops, treat infestation by hand weeding or herbicides control appropriate to the area. Furnish and install weed chemical control as recommended by manufacturer. Herbicides controls must be acceptable to the Owner. Obtain and pay for permits. Use as directed by the manufacturer and applicable laws, codes, ordinances and regulatory requirements. Under

NO circumstances is it acceptable to seed or overseed over Nutsedge, Crabgrass or other grassy/broadleaf weeds.

B. Maintenance by the Contractor continues through the certificate of substantial completion to final acceptance by the Architect as described below. Maintenance by Owner begins after final acceptance of the lawn.

3.8. STANDARDS FOR SUBSTANTIAL COMPLETION OF LAWNS: Review to determine substantial completion of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

A. Lawn areas will be substantially complete provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, partially mature stand of lawn is established free of weeds, undesirable grass species, disease, and insects. With proper watering and maintenance as indicated herein, this should culminate after an approximate 60-72 day period for initial germination with average temperatures above 40°F. Grass roots shall have matured to a minimum of 1½" depth as determined by the Architect when core samples are taken.

B. Lawn areas shall not have more than 10% dead/bare spots.

C. Contractor shall provide a written copy of all maintenance activities performed up to this date.

D. The architect will prepare a written punch list of items which need correction prior to final acceptance.

3.9. STANDARDS FOR FINAL ACCEPTANCE OF LAWNS: Review to determine final acceptance of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

A. Lawn areas will be acceptable provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, full stand of lawn is established free of weeds, undesirable grass species, disease, and insects. Grass roots shall have matured to a minimum of 2" depth as determined by the Architect when core samples are taken.

B. Any lawn which contains disease, more than 1% dead/bare spots, or any dead/bare area greater than one (1) square foot shall be rejected and the unacceptable area(s) repaired as originally specified at no additional cost to the Owner.

C. In the event the Contractor fails to complete the punch list items within a 30 day period with average temperatures of 40°F after the time of Substantial Completion, the Contractor shall be liable to the Owner for any additional costs including those charged by the Architect.

D. Contractor shall provide a written copy of all maintenance activities performed during the contract up to final acceptance of lawns.

3.10. CLEAN UP:

During the contract and at intervals as directed by the Architect and as lawn work is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, neat, well-draining condition.

END OF SECTION

1.0 PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of the storm drainage is shown on the drawings.

B. Storm drainage work includes, but is not limited to:

1. Trenching, backfilling, and compaction
2. Storm structures, castings, and appurtenances
3. Piping, jointing, and fittings
4. Connection(s) to other storm system(s)
5. Adjusting existing storm structures and other utilities
6. Storm Water Management Trench (SMT)
7. Sleeves and seals
8. Quality Control Testing and Submittals
9. Clean Up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 311201 - Site Preparation

B. Section 312501 - Erosion, Sediment and Pollution Control

C. Section 312201 - Site Earthwork: For Elaboration of Shoring and Bracing, Dewatering, Backfilling, Compaction and Field Quality Control Testing.

D. Section 321201 - Asphalt Paving

E. Section 321301 - Site Concrete

1.3 REFERENCES

A. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

1.4 SUBMITTALS: (See Section 311201, 1.5)

A. Shop Drawings (SD) required for:

1. Precast concrete drainage structures showing sizes, elevations for openings and HS20 loading certification.
2. Area Drain Structures

B. Manufacturer's Product Data (MPD) required for:

1. Drainage structures and castings

2. Pipe, joints, and fittings
3. Stormwater Management Trench for Pipes and Geotextiles
4. Sleeves and seals

C. Quality Control Submittals:

1. Provide a list of completed projects including Owner's contact information for each project, demonstrating compliance with applicable "Experience Requirements" specified in "Quality Assurance" of this specification section.

1.5 QUALITY ASSURANCE

A. When trench drain installation is complete verify the elevation of the trench drain by survey method with shots taken at ten (10') feet on center. Plot points and review with Architect prior to proceeding further.

B. Drainage Contractor Experience Requirements:

1. Submit business name, business owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Drainage for this Project.

2. Provide a list of at least four (4) Drainage work projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.

1.6 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. Plan and execute piping work so that trenches are not opened for more than two hundred (200') feet in advance or left unfilled more than one hundred (100') feet behind. No overnight open excavation is permitted.

C. CERTIFICATION OF STORM SYSTEM: The storm system must be installed and certified by a licensed County Plumber when required by municipal code or state law.

D. CONSTRUCTION REVIEW: Notify the Architect when the storm system is approximately 25%, 50% and 95% complete.

1.7 SUBSTITUTIONS

A. Contractor is responsible for design of any substituted structures, systems or units in Section 334001 by a NYS licensed engineer. Submit to Architect for approval.

B. If a product is being submitted as a substitution to the specified product; the the Prime Contractor shall submit and request a product material substitution with his/her bid. The Prime Contractor shall at a minimum provide the following for review by the Architect and Owner:

1. All submittals as specified herein

2. Product comparison

3. Cost Information (including proposal of change in Contract Sum)

4. Contractor's certification that proposed substitution complies with requirements in the Contract Documents

5. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2.0 PART 2 - PRODUCTS

2.1 BACKFILL

A. Backfill for pipes, Stormwater Management Trenches (SMT), drainage structures, and drywells shall be as specified in Section 312201.

2.2 STORM STRUCTURES AND CASTINGS

A. Dry Wells:

1. Shall be pre-cast reinforced portland cement concrete with reinforcement conforming to ASTM C478 and ASTM A615 with AASHTO HS20 Loading. Openings shall be precast in each unit at the factory. Size(s) as shown on drawings and constructed of reinforced Portland Cement concrete; as manufactured by Zeiser Wilbert, Jefferson Concrete, Fort Miller or Architect approved equal.
2. When the size of a manufacturer's product differs from the item as detailed on the drawings, provide the manufacturer's next larger size than detailed unless approved by the Architect in writing.
3. Castings: Provide HS20 loading and bike safe grates, ductile iron meeting grade 65-45-12 as determined by ASTM A536-84, sizes as noted on the plans. Frames, covers and grates shall be machined to prohibit rocking. Standard of Quality shall be Neenah Foundry, East Jordan Iron Works, US Foundry, or Architect approved equal. Refer to drainage details on drawings for model numbers and other information on castings.

2.3 STORM STRUCTURE APPURTENANCES

A. Precast Concrete Adjustment Rings: Shall be square or round depending on structure. Built in accordance to ASTM C478, and made of 5,000 psi concrete and reinforced steel, meeting ASTM A615 Grade 60, as manufactured by Fort Miller, Zeiser Wilbert, Jefferson Concrete or Architect approved equal.

B. Steps: Shall be copolymer polypropylene plastic reinforced with 1/2" diameter grade 60 steel as manufactured by M.A. Industries or Architect approved equal.

C. Mortar: Shall be lime, cement, and clean sand, 1:1:3 measured by volume, meeting ASTM C1107.

2.4 PIPING

A. High Density Polyethylene Pipe (HDPE): Shall be heavy duty dual wall, high density polyethylene (HDPE) pipe conforming to ASTM F2648 for 4" to 60" pipe with a smooth inner wall, annular corrugations, "n" flow rating of 0.012, and HS-20 loading capability with minimum one (1') foot cover for 4" to 48" pipe and two (2') foot cover for 6-" pipe. Joint couplings for pipe shall be connected using a bell &spigot joint, meeting AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Standard of quality shall be N-12 Mega Green ST IB pipe as manufactured by Advanced Drainage Systems, Inc., 800-821 6710, or Architect approved equal.

2.5 STORM WATER MANAGEMENT TRENCH

A. 4" to 10" Pipe: Shall be flexible, heavy duty, corrugated interior and exterior, perforated (or slotted) polyethylene pipe meeting requirements ASTM F-667 for 4" to 10" diameters. Standard of quality shall be ADS with prefabricated snap fittings as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.

B. 12" to 24" Pipe and Fittings: Shall be heavy duty polyethylene (HDPE), corrugated interior and exterior, perforated pipe meeting requirements AASHTO M252, AASHTO M294, Type C. Standard of quality shall be ADS with prefabricated fittings as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.

C. 4" to 12" Fittings: Shall be injection molded fittings with a smooth interior and exterior meeting requirements AASHTO M252 for 4" to 10" diameters, and ASTM M294 or ASTM F2306 for 12" diameter. Standard of quality as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.

D. Backfill: Shall be clean, washed No. 1 stone as indicated in Section 312201.

E. Soil Separation Fabric: Shall be a commercially manufactured non- woven polypropylene filter fabric. Standard of quality shall be Mirafi 140N as manufactured by TenCate or Architect approved equal.

2.6 PIPE SLEEVE AND WATERPROOF SEALS

A. Sleeves shall be constructed of steel with a waterstop and anchor collar, 2" minimum. Sleeve length shall equal foundation wall thickness. Waterproof seals shall be rubber. Standard of quality: shall be the Link Seal Wall Sleeve and Link

Seal Gasket as manufactured by the Thunderline Corporation or Architect approved equal.

3.0 PART 3 - EXECUTION

3.1 CONNECTIONS TO OTHER STORM SYSTEM

A. Connections at Building(s):

1. Locate accurately per site and plumbing drawings. Verify invert and sizes. Notify Architect of any discrepancies immediately, prior to installation.

2. Install pipe and jointing to within five (5') feet of each building exterior. Install temporary plugs, cap end, mark above grade, and protect. Coordinate with Plumbing Contractor. Connection will be made by Plumbing Contractor.

3. The Plumbing Contractor shall be responsible for connecting the building drains and leaders to the site storm system.

4. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.

B. Connections to existing Storm Systems:

1. Coordinate with the Municipality and other agencies having jurisdiction. Notify governing agency in writing a minimum of two (2) weeks prior to anticipated date of connection so that field procedures and installation can be reviewed by a representative of the Municipality. Copy letter to Architect.

2. Locate accurately per drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation.

3. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.

3.2 TRENCHING AND BACKFILL

A. Reference: Refer to Section 312201 for elaboration of shoring and bracing, supporting, rock, dewatering, and backfilling.

B. Trenching:

1. Remove material encountered to the depth shown on drawings and with a maximum width of fourteen (14") inches and a minimum of nine (9") inches each side of conduit springline as detailed. Provide safe shoring, sheeting, and bracing. Remove before backfilling. Backfill excess or over excavation as described in Section 312201 to proper line and grade. Compact to 95% density.

2. When unsatisfactory soil materials are encountered at design elevations, immediately notify the Architect in writing via email. Continue as directed by the Architect. When conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price basis in accordance with specification Section 312201.

C. Water: Remove from trenches; drain trenches and/or provide sump pits and pumping equipment as necessary to keep trenches stabile and dry at no additional cost to the Owner.

D. Soft Material in Trench Bottom: Dry out and stabilize or remove and replace with imported granular backfill material to achieve firm, stable foundation at no additional cost to the Owner.

E. Rock: Remove boulders and rock within one (1'-0") foot of pipe. Provide one (1'-0") foot of granular backfill between rock and conduits at no additional cost to the Owner.

F. Backfill: Conform to details on drawings and as specified. Compact backfill to a minimum 95% of optimum density.

3.3 STORM STRUCTURES INSTALLATION

A. Pre-Cast Structures:

1. Install with corresponding extended precast base section. Precast base units shall be modified in the factory to have the correct size openings for piping.

2. Provide drainage structures as detailed, built to finished grades given. Backfill with imported granular backfill material around drainage structure and compact to 95% density to avoid settlement.

3. Mortaring: Thoroughly wet concrete risers before laying. Mortar joints. Joints shall be completely full and struck flush.

4. Install any required steps in a continuous flight, avoiding any conflict with piping.

5. Construct channels in base of storm structures for positive flow from inlet to outlet piping where detailed.

6. Build completed structure to avoid any infiltration or exfiltration of water except at underdrains or storm water management trenches.

3.4 CASTINGS

A. Provide the type specified and shown on drawings. Build to the finish grade as shown on drawings.

B. Set castings firmly. Loose or rocking castings shall be rejected by the Architect.

C. Paint all installed castings (inside and outside) with two (2) coats of black rust inhibitive paint as directed by the Architect.

3.5 ADJUSTING EXISTING UTILITIES

Adjust existing utilities as necessary to maintain utility service and meet finished grade conditions. Existing utilities include but are not limited to; hydrants, water valves, gas valves, electric pull boxes and manholes, storm drainage structures, cable and telephone markers, fiber optic cables, sanitary cleanouts and manholes, and guy wires.

3.6 PIPE LAYING

A. Shall be in accordance with ASTM D2321 and pipe manufacturer requirements.

B. Bed pipe in granular backfill or concrete as shown on drawings, compact under springline of pipe to assure firm support. Align pipe to line and grade given in plan and profile. Set batter boards or set by laser level.

C. Pipe joints shall be made using the flexible gaskets specified. Clean bell end of any debris and lubricate. Remove protective wrap from gasket. Do not allow lubricated section to touch dirt or backfill. Foreign matter could adhere to surface and compromise joint integrity. Push together pipes so that the gasket is firmly seated in the socket. Always push spigot end into bell, not bell end into spigot.

D. Place backfill around pipes to equal depths on both sides as work progresses.

E. Attach flared end sections as detailed to pipe outlets, draw up bolts tight to provide firm anchorage.

F. "Lamp" pipes to check for misalignment and breakage after backfilling has been completed. Replace pipes deviating more than 1/2" from line or grade at no additional cost to the Owner.

3.7 PIPE SLEEVE AND WATERPROOF SEAL

A. Locate and install sleeves where indicated on the drawings. Maintain the same line and grade of the storm pipe. Coordinate the installation of the sleeve with the other contractors prior to installation.

B. Provide the waterproof seal between sleeve and storm pipe. Installation shall be approved by the Architect before backfill is installed.

3.8 STORM WATER MANAGEMENT TRENCH

A. Use only pipe which is undamaged and flexible (have not been exposed to direct sunlight for more than six (6) months causing brittleness, cracking or splitting prior to placement). Pipe shall be stored for at least twenty-four (24 hrs.) hours in an area having a minimum temperature of fifty (50) degrees F.

B. Trenching: Remove material encountered to the depth shown on the drawings. Provide shoring, sheeting, and bracing as necessary for safety; remove before backfilling.

C. Install continuous envelope of soil separation fabric around the backfill up to subgrade of finish material. Fill stone to proper elevation and wrap top. Overlap fabric minimum twenty-four (24") inches at top and joints. Secure fabric joints to prevent separation and infiltration of adjacent materials and separation of fabric.

D. Install pipe sloped as shown on drawings.

E. Compact backfill to maximum density of adjacent materials.

3.9 FIELD QUALITY CONTROL

A. Density Testing: Perform all density testing for piping trenches and structure backfill as indicated in Section 312201.

3.10 CLEAN UP

A. During the contract and at intervals as directed by the Architect and as storm drainage is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, neat condition.

B. Clean drainage structures, storm water management trenches and pipes: Clean out sediment, rubbish, construction debris, and foreign objects thoroughly, immediately prior to final acceptance.

END OF SECTION

DIVISION 22
PLUMBING SPECIFICATIONS (PC)
INDEX

SECTION	TITLE
220010	PLUMBING WORK GENERAL
220020	CONCRETE WORK
220040	EXCAVATION AND BACKFILL
220055	PAINTING
220519	METERS AND GAUGES
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220553	PIPE IDENTIFICATION & VALVE TAGS
220715	INSULATION
221116	PIPING SYSTEMS & ACCESSORIES
221127	WATER SUPPLY
221130	EQUIPMENT
224240	PLUMBING FIXTURES AND TRIM

SECTION 220010 - PLUMBING WORK GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

1.02 ALLOWANCES, ALTERNATES AND UNIT PRICES

A. Refer to Division 1 specifications for allowances, alternates and unit prices required as part of this Contract.

1.03 INTENT

A. The intent of the drawings and these specifications is to provide all systems complete and operative. Whether indicated on the drawings and/or included in the specification or not, provide all materials, equipment and labor usually furnished with such systems.

1.04 DEFINITIONS

A. Provide: Furnish, install and connect.
B. Furnish: Supply material only.
C. EXR: Existing to remain.

1.05 SCOPE OF WORK

A. Drawings and specifications are complementary and must be so interpreted to determine the full scope of work under this section. Wherever any material, article, operation or method is either specified or shown on the drawings, this Contractor is required to provide each item and perform each prescribed operation according to the designated quality, qualification or condition, furnishing all necessary labor equipment and incidentals.

B. Specifically included, without limiting the generality of drawings and specifications are:

1. Plumbing fixtures and trim indicated.
2. Valves where indicated.
3. Connection to equipment "by others" as indicated.
4. Temperature mixing valve.
5. Hot and cold water lines, recirculating lines.
6. Sanitary drainage and vent lines.
7. Connection to existing water and sewer mains.
8. Thermal insulation on hot and cold water systems.
9. Excavation and backfill for interior and exterior piping and structures.
10. Connections to and from site utilities at 5’ out structure unless otherwise noted.
11. Remove existing plumbing fixtures where indicated.
12. Remove existing plumbing piping systems and equipment where indicated.
13. Replacement of faucets, traps, and drains at existing fixtures.
14. Replacement of non-operational control valves.
15. Tests: This contractor shall furnish materials, equipment and labor and shall perform all work of testing of the plumbing systems as outlined hereinafter. Testing procedure shall include installation tests and operating tests.

1.06 TEMPORARY SERVICES

A. Temporary Heat: In accordance with Architect's specifications and/or conditions, contractor shall have the permanent heating system capable of providing heat to the new work areas when required. The term heating system shall include all work or components necessary to operate heating system. For temporary usage, it is not required that this work be in a finished condition, i.e., covers in place, etc. Cost of fuel consumed for temporary heat from permanent systems only shall be paid by owner.

B. The use of permanent system will be allowed only if the building is fully enclosed with no construction dust to clog heating/cooling coils, heat recovery components, fans, etc.

C. At the completion of work, Contractor shall turn over to the Owner all equipment used for temporary heat in a new, as purchased condition. Contractor shall replace filters with new ones, clean all components which shall include: unit casings, ductwork, grilles, diffusers, etc., re-lubricate all moving parts, replace belts if required and perform any other work necessary (as determined by Architect and Engineer) to put equipment in a "new" condition.

D. Contractor shall take all measures necessary to insure that dust, dirt, or debris does not enter air systems while in operation for temporary heat and shall change filters as often as necessary. Under no circumstances shall air handlers be allowed to operate with no filter in place.

1.07 CONTINUITY OF UTILITY SERVICES

A. It is of paramount importance that each utility service operate continuously and without interruption. Whenever this contractor plans to make changes or alterations to any existing utility service, such plans shall result in no or minimum service interruption or inconvenience to Owner. This contractor shall plan and schedule any change or alteration to an existing utility service with Architect and Owner. Such planning, timing, and/or scheduling shall be approved by both these parties.

1.08 CODES AND STANDARDS

A. All materials, equipment, and installations by this contract shall be in accordance with the latest editions of the following applicable requirements:

1. 2020 International Building Code, including all applicable amendments supplements to the following:
   a) 2020 International Building Code
   b) 2020 International Existing Building Code
   c) 2020 International Fire Code
   d) 2020 International Plumbing Code
   e) 2020 International Mechanical Code
   f) 2020 International Fuel Gas Code
2. 2020 Supplement to the New York State Energy Conservation Construction Code including all applicable amendments to the following:
   a) 2020 International Energy Conservation Code
   b) 2020 ASHRAE 90.1
3. 2020 Uniform Code Supplement (May 12, 2020)
4. Lead testing in school drinking water (10 CRRNY 67-4)
5. Conform to requirements of NEMA.
6. Liquefied Petroleum Gas Code - NFPA 58.
7. Bear label of Underwriters Laboratories, Inc.
8. National Electrical Code NFPA Article 70, latest edition.
9. New York State Health Code.
10. Local Utility Standards.
11. Local Municipal and/or City Standards.

12. Industrial Code Rule #4 and #14 (12NYCRR 4 and 14) (Standards for Boiler Installation).
13. Conform with applicable requirements of ASTM - Regulations and Standards for Pipe and Pipe Fittings.
14. Be in accordance with USAS - Code for Pressure Piping, latest edition.
15. For external and internal pipe insulations, have flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with ASTM Standard E84.
16. Sheetmetal and Air Conditioning Contractor's National Association, Inc. (SMACNA), latest editions.
17. Conform with applicable requirements of Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA 90A, and Code for Safety to Life from Fire in Buildings and Structures, NFPA 101.
18. Be in accordance with design standards outlined in ASHRAE Handbooks, latest edition.
19. Conform to requirements of Owner's insurance carriers.

1.09 SUBMITTALS AND SUBMISSION REQUIREMENTS

A. All submittals shall be in accordance with Division 1 requirements, the following requirements listed below, and also as indicated in each specification section. All submittals not complying with the listing above will be returned to the contractor without being reviewed. Rejection by Architect or Engineer of any items submitted shall require resubmittal of acceptable items.

1. Within (30) days after receiving signed contract or notice to proceed, submit to Architect for review complete descriptive dimensional data and ratings for equipment and materials proposed to be furnished and installed. Submit (8) copies of data unless otherwise specified by the architect.

2. All materials submitted shall clearly state the job name and specification section(s) that it applies to.

3. Any package containing more than one piece of equipment or material shall also contain a schedule clearly listing all items in submittal. Schedule page(s) shall also indicate project name and building name.

4. All submittals must be clearly marked using nomenclature used in this specification for proper item identification, schedule of usage's, model numbers, construction materials, performance, data, etc.

5. Projects involving multiple buildings must have the submittals separated by building. Submittals in which buildings are combined will not be accepted. (Exception: When specifically approved by engineer, basic materials may be submitted once.)

6. The contractor shall verify and insure that dimensions and elevations of equipment and structures to be used conform to the space allocated for the equipment on the drawings, and complies with existing conditions.

7. Submittals traced or copied from contract drawings are not acceptable and will be returned without review.

8. In the event material and/or equipment is installed prior to obtaining approval of shop drawings, and in the sole opinion of the Owner's Agent, this material and/or equipment does not meet the specifications, the Contractor shall be liable for the removal and the replacement at no additional cost to the contract.

B. Samples: When requested by Engineer, provide samples of both specified equipment and proposed substitutions for review by the Owner's Agent. Such equipment shall be delivered to a location designated, or erected at the job site as directed. When neither is physically possible, arrange for the Owner's Agent to visit an acceptable site where the proposed equipment can be inspected.

C. Substitutions:

1. Submittals for equipment or materials other than as specified shall be accepted for review by the Owner's agent.

2. Approval of substitute equipment shall be based on functional, physical and aesthetic compatibility to the equipment specified as determined by the Owner's agent and approved by the engineer.

3. Where substitute equipment is approved, the contractor shall be responsible for, and bear the cost of any necessary changes by his trade or other trades to make the system complete and operable.

4. Contractor is fully responsible for providing coordination between all trades affected by equipment substitution.

5. When requested, contractor shall submit layout drawings indicating new dimensions and arrangements of substituted equipment. Layout drawings shall indicate all revisions necessary for all services affected by substitution.

1.10 SUBSTANTIAL COMPLETION REQUEST FOR PUNCH LIST

A. Contractor shall submit a letter in email form stating that the work is substantially complete and ready for Punch List review by Engineer.

B. Contractor shall note which areas are substantially complete by Building (if multiple buildings) and by Area according to the Key Plan.

C. Contractor shall list all items that are known to be incomplete at time of submission.

D. If the request is for a partial Punch List, Contractor shall also include a list of room numbers/room tags.

E. When letter is received by the Engineer, site review(s) will be coordinated with the Construction Manager, Clerk, Architect.

1.11 CUTTING AND PATCHING

A. This contractor shall bear the cost of all cutting and patching required by and for the installation of this work. This contractor shall perform all cutting and patching unless otherwise indicated on drawings or if directed by the Architect.

B. Patching of fire rated floors, walls, partitions, etc. shall be made using new materials equal to the fire rating of the existing.

C. Should changes, omissions or errors in this contract's work require cutting, patching or making alterations in any portion of new construction, such work will be performed by GC at this Contractor's expense.

D. Cutting and patching of roof surfaces and structures shall only be performed by a qualified contractor, as approved by the Architect. The work of this contract shall bear the cost of above mentioned cutting and patching. This contractor shall insure that existing roof warranties remain in force.

E. This contractor shall furnish lintels, sized to accommodate structure above opening, where cutting and patching is to be performed on load bearing walls. Contractor shall obtain written approval for all lintels prior to installation.

F. Cutting shall be done in a manner which will not adversely affect the strength of the building. Holes and openings shall be neatly cut so as to provide a finished appearance and shall be patched around the edge where required for a finished appearance. Provide temporary bracing, shoring, etc. as required.

G. Patching shall be structurally sound and match the existing materials and finish of adjacent materials. Patching is required in finished areas, wherever existing work is removed, at the sides of openings, etc.

H. At the completion of the work, all evidence of alteration will be as inconspicuous as possible.

1.12 FIELD INSPECTION

A. As there are various conditions at the site which do not show on the accompanying drawings, or which are at variance with the conditions indicated on the drawings, it is important that each bidder visit the site and acquaint himself with existing conditions, and take these conditions into consideration when preparing his proposal. Each bidder shall obtain information or make any measurement desired. Lack of knowledge relative to existing conditions will not be allowed as a basis for extra compensation.

B. This contractor and his subcontractors shall inspect existing equipment to remain prior to any of his new work in order to determine that all equipment is in good operating condition. If equipment is found to be lacking components, is inoperable, damaged, etc., contractor shall provide immediate written notice to the Owner. The Owner or his representative shall determine if any additional work is necessary and the method by which any work shall be performed.

1.13 INSTRUCTION SERVICES AND MANUALS

A. Instructions:

1. Provide competent personnel to remain at the jobsite for necessary time to instruct the Owner's personnel in proper operation and maintenance of installation made by this contractor.
2. This contractor shall be responsible for notifying and instructing Owner's personnel on all equipment operations, maintenance requirements, etc. Furnish operating training session(s) for equipment listed.
3. The Owner shall be responsible for establishing an operating and maintenance program for all equipment listed.

B. Training Session: A training session shall be held for each system and/or item listed below:

Item	Description	Training Hours For Each Bldg
1.	Flush Valves	1/2
2.	Hot Water System	1/2
3.	Tempered Water Valve Operation	½

C. The instruction shall include the following types of information:

1. System overview
2. Major component designation
3. System operation procedures
4. Maintenance scheduling and procedures
5. Provide a list of spare components each system would normally require

D. Services: Provide services required, for all equipment specified under this contract, for a period of (1) year after written acceptance by the Owner.

E. Manuals: Submit (3) sets of Operation and Maintenance manuals. Each set shall contain the manufacturers' data, operating instruction parts catalog and maintenance procedures for each piece of equipment. Include normal maintenance servicing schedule to be performed by the Owner.

1. For projects containing multiple buildings, manuals shall be submitted separately for each building.

1.14 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. At completion of work, contractor to submit written report of acceptance by service representative and/or qualified third party testing agency that systems are installed in accordance with manufacturer’s details and requirements.

D. Delegated Design Systems:

1. None Applicable.

1.15 PERMITS, CERTIFICATES AND FEES

A. This Contractor shall obtain and pay for permits, certificates, fees etc. listed below. Costs for permits, fees etc. shall be included in the Base Bid amount.

1. All required applications and permits to begin work
2. Certificate of inspection including Third Party Agent
3. All municipal connection charges
4. All local utility charges (gas etc.)
5. Fees and charges shall be obtained directly from the respective authority having jurisdiction.

1.16 REMOVAL, DISPOSAL AND HAZARDOUS MATERIALS

A. All removed equipment shall be removed from the site and properly disposed of.

B. All hazardous materials must be disposed of in compliance with ENCON and all other regulatory agencies.

C. The Owner may wish to keep certain equipment, therefore, check with Owner before removals to determine what may be salvageable.

1.17 GUARANTEE

A. Contractor shall guarantee all work furnished through this contract including work performed by sub-contractors, for a period of (1) year (unless otherwise noted), from the date of final acceptance. Contractor agrees to repair or replace any defective work or materials at no additional cost to the Owner. Contractor shall also pay for any damage to other work resulting from repairs to defects. Contractor shall furnish written guarantees to the Owner's agent in accordance with the general conditions.

1.18 INSTALLATION

A. This contractor shall coordinate scheduling and installation of work with other contractors, sub-contractors and other trades. The contractor is also required to coordinate all work with owner supplied materials, direct contracts, and normal building operations, if any.

B. All finished work shall be neat and workmanlike. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade. New systems shall be delivered to Owner complete in perfect working order, tested and balanced in full accordance with plans and specifications. Existing systems shall function in same manner as before this work was performed. Any malfunctions which arise in existing systems as a result of demolition or alteration of parts of such systems shall be corrected.

C. Layout of equipment, accessories and piping systems in plan is generally diagrammatic unless specifically dimensioned or detailed. Check project drawings and existing site conditions before installing work for interference's as governed by structural or other conditions. Owner reserves the right to make reasonable changes in location of equipment, accessories or piping systems prior to "roughing-in" without involving additional expense. Exact dimensions shown upon plans will be subject to verification and confirmation of exact conditions at site at time of construction. "Plus or minus" dimensions are shown upon drawing as a guide only. Exact surrounding conditions are governed by final equipment selection and/or other like details.

D. Furnish all new equipment and materials as described herein. Any material, operation, method or device mentioned, listed or noted within this specification, if not specifically mentioned as furnished or installed by others, shall be furnished and installed by this contractor.

1.19 TESTING AND INSPECTION

A. Inspections required for any ordinances, regulations, instructions, laws, rules, standards and practices that require any work to be inspected or tested shall be performed. Contractor shall give Owner, Architect and Engineer timely notice of readiness of work for inspection or testing and the date fixed for said inspection or testing.

B. Third-Party Agency must inspect completed installation and present Owner with Certificate of Inspection showing approval.

C. Required local or municipal inspection processed and present Owner with certificate indicating approval of such governing bodies.

D. Contractor shall submit a written report to Architect, copy to Engineer, on results of each inspection or test on system or equipment supplied. Report shall contain all pertinent information, recommendations, approvals, additional work required, etc.

E. Tests:

1. After installations are completed and before insulation is applied, walls are closed, or trenches backfilled, all portions of the installation shall be tested in accordance with the procedures described herein.

2. Provide hydrostatic pressure test for storm water sanitary and vent pipe with 10' or more developed length. Test pressure shall be a minimum of 10' water column at all points except the upper most portion of the roof vent or drain terminal. Piping shall be tested in sections with approved test plugs, duration of the test shall be one hour. In addition to the pressure test described above, Contractor shall provide a flow test for each section of the plumbing drainage systems to verify that there are no blockages. All pipes must be exposed during testing unless otherwise approved by Engineer.

3. Interior domestic water piping shall be tested at 125 psi pressure. Contractor shall fill piping at the beginning of working day and maintain pressure for two hours with no pressure loss. If no leaks are found, the piping shall be allowed to remain under pressure overnight and then be inspected the next morning. No insulation shall be applied to the piping until the test is complete.

1.20 RECORD DOCUMENTS

A. When required by general conditions or other Division 1 Section this Contractor shall prepare and turn over to Owner's agent record As-built documents. As-built drawings will include actual equipment location layout, service connections, ductwork and piping layouts, valve locations, etc.

B. In all projects, contractor shall provide record drawings of all underground equipment and service runs. As-built drawings for underground work will include dimensions to actual locations finish grade elevations, and actual invert to underground structures equipment and service runs.

1.21 IDENTIFICATION AND NAMEPLATES

A. Provide engraved plastic labels screwed to equipment furnished under this contract including control panels, starters, switches, panels, etc. Labels shall have black background, white letters; minimum letter height 3/8" high, self adhesive labels or punch tape type labels are not acceptable.

1.22 PENETRATIONS THRU FIRE RATED CONSTRUCTION

A. All penetrations by this contract through rated construction shall be sealed fire safe by a UL listed approved method.

B. All piping penetrations through walls, floors, etc. shall be sleeved.

C. All piping penetrations through fire rated partitions, walls, floors, etc. shall be installed as follows; penetration shall be oversized 1/2" to 3/4" maximum. This contractor shall pack with fireproofing insulation, type FS cerablanket. Outside of penetrations (exposed surfaces around pipes and ductwork) shall be caulked and sealed with flame stop V, as manufactured by Flame Stop, Inc.; or an approved equal. Flame stop sealant shall be troweled smooth for finishing as required.

1.23 CONFINED SPACES

A. All work in pipe tunnels, mechanical pits, well manholes, etc. shall be performed by skilled tradesman and laborers with current certification for working in confined space. Contractor shall bear all costs to provide all safety equipment, ventilation, etc. as required by State and Federal Regulations and shall obtain all necessary permits for such work.

B. Contractor shall submit copy of current certifications and photo I.D. of all tradesman and laborers who will be working in confined spaces on this project.

1.24 COORDINATION DRAWINGS

A. Before construction work commences, Contractors for all trades shall submit Coordination Drawings at not less than 1/4" = 1'-0" scale. Coordination Drawings are required throughout all areas for all trades. These drawings shall identify and show resolutions of trade conflicts. Mechanical Equipment Rooms shall be drawn early in the Coordination Drawing process, simultaneous with all other congested areas. Prepare Coordination Drawings as follows:

1. HVAC Contractor will prepare the base plan Coordination Drawings showing all ductwork and all pertinent piping and equipment. The drawings shall be coordinated with cable tray, lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner and the Architect. Provide adjustments to exact size, location and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of Base Bid Contracts. Minor revisions need not be redrawn.

2. HVAC Contractor will provide prints and CAD drawings and submit the base plan to all major trades' Contractors.

3. Electrical, Plumbing and Fire Protection Contractors will draft location of piping and equipment on the base plan, indicating areas of conflict and suggested resolutions.

END OF SECTION

SECTION 220020 - CONCRETE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including the General and Supplementary conditions and Division 1 Specification Sections apply to the work of this Section.

1.02 SUBMITTALS

A. Concrete mix designs.
B. Reinforcing materials.
C. Shop drawings for reinforcing arrangements.
D. Concrete test reports.

1.03 QUALITY ASSURANCE

A. Comply with provisions of the following, specifications and standards, except where more stringent requirements are specified:

1. The American Concrete Institute (ACI) "Manual of Concrete Practice".
2. Applicable ASTM Standards.
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Concrete Practice".

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Metal forms shall be clean, free from rust and free from dents.

B. Form lumber shall be new when used for the first time on this job.

C. Plywood shall comply with United States Product Standard PS-1 for Plyform Class 1, Structural 1, Exterior Grade B-B or better.

D. Form coating compounds shall be of a commercial formulation that shall not bond with, stain or adversely affect the concrete surface. Confirm that any form coatings to be used are compatible with any concrete finish to be applied.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars (ReBar) - ASTM A615, Grade 60, deformed, shop fabricated.

B. Welded Wire Fabric (WWF) - ASTM A185, Welded steel wire fabric, in flat sheets only.

C. Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening Reinforcing Bars and Welded Wire Fabric in place. Use wire bar type supports complying with CRSI Class III recommendations.

D. For slab-on-grade use supports with sand plates or horizontal runners where chair legs will damage vapor barrier.

2.03 CONCRETE AND GROUT MATERIALS

A. Cement shall conform to ASTM C-150 Type I.

B. Normal weight concrete aggregates shall conform to ASTM C-33.

C. Concrete shall conform to ASTM C-94 for Ready Mix Concrete. Concrete shall have a minimum 28 day compressive strength of 3000 psi using a minimum of six sacks of cement per cubic yard. The slump for all concrete shall not exceed 4".

D. Time limit for concrete delivery truck shall be a maximum of 45 minutes.

E. Admixtures shall be compatible with all other materials to be used and shall meet the following:

1. Air-entraining agent shall conform to ASTM C260. Air entrainment shall be between 5% and 7% in all concrete exposed to freezing and thawing.

2. Chemical admixtures shall conform to ASTM C494 and must be specifically approved by Architect prior to their inclusion into any concrete. Calcium chloride shall not be used in any form.

F. Grout shall be non-shrink, non-metallic, high strength (5000 psi minimum at 28 days) cementitious material.

2.04 RELATED MATERIALS

A. Moisture retaining cover shall comply with ASTM C171, including waterproof paper, polyethylene film and coated burlap.

B. Absorptive cover shall be burlap cloth from jute or kenot, weighing approximately 9 oz. per sq. yard complying with AASHTO M182, Class 2.

C. Water resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and over-coated with black polyethylene on each side.

D. Vapor barrier consisting of seven-ply membrane with reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating and plastic anti-stick sheet. Water vapor transmission rate of 0.00 grains per sq. ft. per hour when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

E. Bonding agents shall be a 2-part, high modulus, moisture insensitive, polysulphide free, rigid epoxy containing 100% solids and shall conform to ASTM C-881, Type 2, Grade 2, Class B; ASTM C-883; ASTM D-638 and ASTM D-695.

F. Provide for installation of inserts, sleeves, fastening devices, dowels, etc. as required.

2.05 TESTING

A. Independent testing laboratory shall prepare cylinders, transport for lab cured specimens, perform all testing, and submit written test reports.

B. Sample fresh concrete (ASTM C172) at time of delivery.

C. Slump (ASTM C143) one test for each days pour for each class of concrete.

D. Air content (ASTM C231), pressure method for normal weight concrete, one test for each days pour or each time compression test cylinders taken.

E. Compression test specimens (ASTM C31), 4 standard cylinders. Stone and cure at testing laboratory. Prepare one set for each truck. Log locations of each test specimen.

F. Compressive strength testing (ASTM C39), first test at (7) days, second test at (14) days, third test at (28) days and fourth cylinder held in reserve for backup testing if required.

G. Test reports shall indicate name of testing company, cylinder identification, sample location, date of placement, concrete type, design strength, actual strength.

PART 3 - EXECUTION

3.01 FORM WORK

A. Forms shall be constructed to conform to the required shapes, dimensions, line elevations and positions and shall be maintained sufficiently rigid and tight to prevent deformation under load and to eliminate cement leaks. Form surfaces shall be thoroughly cleaned for each use. Forms shall be oiled before reinforcing steel is placed.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Bevel wood inserts for forming keyways, recesses, etc. for easy removal.

C. Coordinate form-work installation with other trades.

3.02 REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.

C. Place reinforcement to obtain at least minimum coverages of concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 CONCRETE PLACEMENT

A. Pre-Placement Inspection: Before placing concrete, inspect and complete framework installation, reinforcing steel and items to be embedded or cast-in. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. General: Comply with ACI 304, as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

C. Placing concrete in forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer in still plastic to avoid cold joints.

1. 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 recommended practices.

2. Do not use vibrators to transport concrete inside forms.

D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position during concrete placement operations.

E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.

F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

3.04 SURFACE FINISHES

A. Rough Form Finish: For formed concrete surface "below grade" not exposed-to-view. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Trowel Finish: Apply trowel finish to interior equipment and housekeeping slab surfaces to be exposed-to-view. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as a trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Grind smooth any surface defects.

C. Non-Slip Broom Finish: Apply to exterior above or at grade slab surfaces. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to the short edge and finish slab perimeters with an edging tool.

D. Equipment Support Base Finish: Concrete surfaces of equipment support bases shall be finished per equipment manufacturer's recommendations.

E. Piers Finish: Top of piers shall be shaped to shed water and finish for support leg or equipment mount shall be per equipment manufacturer's recommendations.

3.05 CONCRETE CURING AND PROTECTION

A. Curing shall be accomplished by preventing loss of moisture, temperature change greater than 5°F in one hour to 50°F in any 24 hours, mechanical injury, or injury from rain or flowing water for a period of not less than (7) days. Curing compounds, if used shall be checked for compatibility with all finish coats.

B. Curing shall be started as soon as free water has disappeared from the concrete after placing and shall be accomplished by keeping the concrete surfaces damp. Where formed surfaces are cured in the forms, the forms shall be kept continually wet. If the forms are removed before the end of the curing period, curing shall be continued with moisture-cover curing method as described below.

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

3.06 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension and holes left by tie rods and belts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of the Engineer. Surface defects include: irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface. Flush out form tie holes, fill with dry pack mortar.

END OF SECTION

SECTION 220040 - EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions and Division 1 Specifications Sections, apply to the work of this section.

1.02 SUBMITTALS

A. Product data for all materials; including but not limited to:

1. Each type of plastic warning tape.
2. Geotextile.
3. Controlled low-strength material, including design mixture.
4. Geofoam.

1.03 GENERAL REQUIREMENTS

A. Comply with requirements of governmental agencies having jurisdiction.

B. Locate underground utilities and coordinate their preservation.

C. Secure approvals of governmental agencies having jurisdiction and of adjacent property owners, if required.

D. The Contractor must examine all boring reports included in the Contract Documents prior to bidding this work. The presence of water or adverse soil conditions are not a basis for extra compensation.

E. Proceed with and complete grass and/or pavement area restoration work as rapidly as portions of site become available working within seasonal limitations.

F. Follow locations and elevations on drawings where applicable. Contractor shall coordinate work with existing conditions and final grade and configurations.

G. Inspect the areas and conditions under which excavating, filling and grading are to be performed. Commencement of excavating, filling and grading will constitute acceptance of conditions under which work is to be performed.

H. Any damage to underground utilities as a result of this work is the responsibility of the Contractor and must be repaired at no cost to the Owner.

1.04 PROTECTION OF PERSONS AND PROPERTY

A. It shall be noted and stressed that this contractor's installations will be made during a period when the existing building(s) are in use. Contractors shall schedule and conduct their operations so as to cause the least amount of inconvenience to the owner. Contractor shall provide all possible safe-guards to protect students and others at the site.

B. Barricade open excavations occurring as part of this work. Furnish night lighting as required.

C. Contractor shall furnish, erect and maintain barriers where feasible or directed to separate construction activities from other operations on site. Gates may be provided where required. Contractor shall limit operations and activities to fenced areas where applicable.

D. Protect structures, utilities, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards caused by earthwork operations.

E. Perform any shoring and bracing required to safely do the work required. Maintain sides and slopes of elevations in a safe manner. Provide necessary sheet piling and/or shoring needed for protection of workman, materials, buildings, other properties, and the public.

F. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

G. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

H. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

I. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

J. Contractor is responsible for all sheet piling and shoring required, any sheet piping provided is to be installed under supervision and approval of a Certified Professional Engineer.

1.05 EXISTING UTILITIES

A. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

B. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect, and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner and Architect immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

1.06 WATER CONTROL

A. Contractor shall furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations if required and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
4. Remove dewatering system if no longer needed.

B. It is the responsibility of the Contractor to examine all available information prior to bidding to determine existing water table elevation. Dewatering must be covered in Base Bid, no extra compensation for dewatering will be allowed.

C. Comply with water disposal requirements of authorities having jurisdiction.

D. Installation: Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

E. Before excavating below ground-water level, place system into operation to lower water below excavation depth. Operate system continuously until construction is complete and fill materials have been placed, or until dewatering is no longer required.

F. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed.

1.07 PIPING TRENCH EXCAVATION

A. Excavation shall allow for direct buried anchors. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are located in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines. The excavation should be in a straight line except where fittings are located.

B. The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation but in accordance with current OSHA Standards.

C. Where suitable soil exists, pipe shall be installed to comply with ANSI/AWWA C151/A21.51 Laying Condition Type 2. This shall consist of a flat bottom trench with undisturbed earth backfilled and lightly consolidated to centerline of pipe. Where drainage pipe is installed, bottom of trench shall be uniformly sloped. In all cases, pipe bells shall be excavated to provide uniform support.

D. Where unsuitable material exists, pipe shall be installed to comply with ANSI/AWWA C151/A21.51 Laying Condition Type 4. This shall consist of a pipe bedded in sand, gravel or crushed stone ASTM D2940; except 100% passing a 1" (25mm) sieve and not more than 8% passing a No. 200 (.075mm) sieve; to depth of 1/8 pipe diameter, 4" minimum. Backfill compacted to top of pipe 80% Standard proctor factor AHSHTO T-99.

E. If necessary to remove unsuitable material to a depth greater than specified, refill excavations carried below the depth indicated or directed with specified bedding material in 6" lifts compacted to 95% of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the Contractor's operations or soils permitted to soften from exposure to weather, with bedded material and compact with a plate-type vibratory compactor to the specified density.

1.08 REMOVALS

A. Perform the work of demolition at the existing sites as indicated on the drawings and/or as required by the new construction. All materials removed shall be examined by the Owner. Those materials designated by the Owner as "scrap" shall become the property of the Contractor and removed from the site; Materials to be retained by the Owner shall be delivered to the Owner at location as directed.

B. All excess soil removed from excavations, existing concrete sidewalks, etc. not to be reused as backfill, shall be trucked from the site and disposed of by the Contractor.

1.09 MAINTENANCE & REPAIR OF EXISTING FACILITIES

A. Before work is started, the contractor shall inspect the existing work which will be affected by his operations. For the contractor this will include, but is not limited to, driveway, roads, lawn area, walks, shrubbery, etc.

B. Contractor shall report in writing any observed defects to the Owner in order to avoid his being held responsible for damage which may not be his fault.

PART 2 - PRODUCTS

2.01 SUITABLE BACKFILL MATERIAL

A. Excavated or borrow material shall be predominantly granular, non-expansive and free from roots, rocks or lumps over 3" and deleterious matter.

1. Gravel: Run of bank gravel, reasonable free of loam, silt and clay.

2. Stone: Select, graded crushed stone, free from organic, frozen or deleterious matter.

2.02 GRASS RESTORATION

A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official seed Analysts of North America.

Grass seed Mixture:

% By Weight	Purity Species or Variety	Germ Pct.	Max. Pct.	Weed Content %
30%	Kentucky Blue	85%	80%	0.50
50%	Chewing Red Fescue	98%	85%	0.50
10%	Perennial Rye	98%	90%	0.50
10%	Annual Rye	92%	90%	0.75

B. Fertilizer: Provide fertilizer with not less than 10% nitrogen, 10% phosphoric Acid and 5% potash. Complete organic, slow-release type fertilizer of neutral character.

C. Lime: Natural dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve.

D. Topsoil: Provide acceptable topsoil free of roots, plants, sods, stones, clay lumps and other extraneous materials harmful or toxic to grass growth.

2.03 MATERIALS

A. Provide materials that are either new or in serviceable condition. The Contractor is responsible for determining what materials and methods are required to properly shore all excavations.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application (3000 psi unless otherwise noted in Contract Documents).

F. Reinforcing Bars: ASTM A 615/A 615M, Grade 420, deformed, size as shown on Contract Drawings.

2.04 SOIL MATERIALS

A. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

2.05 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: [0.5] per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

2.06 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1.	Red	Electric
2.	Yellow	Gas, Oil, Steam, and Dangerous Materials
3.	Orange	Telephone and other Communications
4.	Blue	Water Systems
5.	Green	Sewer Systems

PART 3 - EXECUTION

3.01 EXCAVATION

A. Perform excavation of all types of materials encountered within the limits of the work. Unless otherwise noted, all excavations shall be open cut.

B. Excavate accurately to the cross sections, grades and elevations shown on the drawings or as required to run proper pitches and set invert elevations.

C. When rock or other unsuitable material is encountered, remove an additional 6" and fill to the proper grade.

D. Maintain excavations free from water.

E. Use necessary means to prevent dust from becoming a public nuisance.

F. Protect excavation bottoms against freezing when temperature is less than 35°F.

G. Use means necessary to avoid displacement and injury to pipe, conduit and structures by heavy construction machinery.

H. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

I. Locate and retain soil materials away from edge of excavation.

J. Dispose of excess soil material and waste materials as specified by Owner.

K. The bottom of trenches shall be accurately graded to provide uniform bearing and support. Wet or otherwise unstable soil that is incapable of properly supporting the equipment or pipe, as determined by the Architect, shall be removed to depth required and excavation backfilled to proper grade with gravel.

3.02 BACKFILL AND FILL

A. Place suitable soil materials in layers as required for each area classification listed below:

1. In excavations, use suitable excavated or borrow material.

2. Under concrete walks and slabs, use gravel, to 8" compacted thickness.

3. Under building slabs and within foundations walls, use gravel, up to a 6" compacted thickness.

B. Backfill excavations as promptly as work permits, but not until completion of inspection, testing approval, and recording locations of underground utilities.

C. Placement and compaction: Place backfill and fill materials in layers of not more than 8" in loose depth. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density. Do not place backfill on surfaces that are muddy, frozen or containing frost or ice.

D. Place backfill and fill material evenly adjacent to structures. Take care to prevent wedging of backfill against structures by carrying the material uniformly around structures to approximately the same elevation in each layer.

E. All excavations shall be carefully backfilled with materials approved for backfilling. Backfill for piping trenches shall consist of earth loam, sand and gravel, or approved material, free from large clods of earth or stones. Backfill shall be deposited in eight inch (8") layers, thoroughly and carefully rammed, until the pipe and tanks have a cover of not less than two feet (2'). Remainder of backfill material shall than be placed into trench in one foot (1') layers and tamped. Any trenches improperly backfilled shall be re-opened to depth required for proper compaction, then refilled and compacted with surface restored to required grade and compaction.

3.03 COMPACTION

A. Control soil compaction during construction to provide the minimum percentage of density specified for each area.

B. Provide not less than the following maximum density of soil material for each layer of actual material in place.

1. Lawn and Unpaved Areas: Compact the finished 8" and each layer of subfill to 90% modified proctor.

2. Walks and Paved Areas: Compact the finished 8" and each layer of subfill to 95% modified proctor.

3.04 GRADING

A. Uniformly grade areas within limits of this work, including adjacent transition areas. Compact with uniform levels or slopes between finished elevations and adjacent existing grades.

B. Grade areas to achieve drainage away from structures and to prevent ponding.

C. Soft spots are to be re-excavated and backfilled with suitable material.

3.05 COMPACTION TESTING

A. Where required, compaction testing shall be performed for each fill or backfill lift level at location frequency specified herein.

B. Proceed with subsequent earth moving and/or paving or equipment placement only after test reports comply with project requirements.

C. Work put in place with noncomplying conditions will be replaced, at contractor's expense, at the direction of architect or engineer.

D. For noncompliance areas as materials are being replaced, retest and submit reports as required until specified conditions are met.

E. Compaction Testing Frequency:

1. Test at each sub grade and compacted fill or backfill layer.

2. Test frequency shall be (1) one test for each area dimension indicated. Where total is within frequency shown a minimum of (2) two test are required.

Area Type	Minimum Test Frequency
Trench	150 ft trench
Foundation	100 ft length or at each trench intersection with foundation
Roadway Paving	300 ft2
Sidewalk Paving	500 ft2
Building Slab	500 ft2 or at trench lengths 100 ft

3.06 MAINTENANCE

A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

B. Where compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape and re-compact to required density.

3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. If specifically directed by Owners Representative, transport acceptable excess excavated material to designated soil storage areas on the Owner's Property.

B. Remove unacceptable excavated material, trash, and debris resulting from this work, from the Owner's property and legally dispose of it.

END OF SECTION

SECTION 220055 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including the General and Supplementary conditions and Division 1 Specification Sections apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work includes field painting of exposed exterior pipes, hangers, exposed steel supports, hardware and iron work.

B. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, and other applied materials whether used as primed, intermediate or finish coats.

C. Paint exterior surfaces except where material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. Architect will select colors from standard colors available for materials systems specified.

D. Operating Parts and Labels: Moving parts of operating units, mechanical parts, such as valve operators will not require finish painting.

E. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

F. Piping Systems Paint Schedule: The following systems or portions of systems which are exposed to the exterior, shall be painted as indicated.

1. Sanitary Sewer and Vent Piping Systems: Paint all exterior exposed piping. Color to match building façade, or yellow for areas 10'-0" away from building.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's color data, and technical information including paint label analysis and application instructions for each material proposed for use.

1.04 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name, trade name, and label analysis.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.

C. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.05 JOB CONDITIONS

A. Apply paint only when temperatures of surfaces to be painted and surrounding air temperatures are between 50°F and 90°F, unless otherwise permitted by paint manufacturer's printed instructions.

PART 2 - PRODUCTS

2.01 COLORS AND FINISHES

A. Prior to beginning work, contractor shall furnish (3) color charts of each type of paint materials to be used; Architect will select colors for surfaces to be painted.

B. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

C. Paint Coordination: Provide finish coats which are compatible with prime paints used.

2.02 MATERIAL QUALITY

A. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers including, but not limited to, Benjamin Moore and Co., and Pratt and Lambert, Inc. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

1. Proprietary names used to designate materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products or other manufacturers.

2. All products shall be LEAD FREE, 0% content.

B. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

C. Ferrous Metal:

1. Semi-Gloss Alkyd Enamel Finish:
2. 1st Coat - Moore Iron Clad Retardo Rust Inhibitive Paint
3. 2nd and 3rd Coats - Moore Alkyd Dulamel

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which painting work is to be applied. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each substrate condition.

B. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

C. Wood: Clean wood surfaces of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Scrape and clean small, dry, seasoned knots and apply thin coat of white shellac or other recommended knot sealer.

D. Ferrous Metals: Clean ferrous surfaces, which are not shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum-based solvent.

3.03 MATERIALS PREPARATION

A. Mix, prepare and store painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

A. Employ only skilled mechanics and apply painting and finishing materials in accordance with manufacturer's directions. Use applicators and techniques best suited for materials and surfaces to which applied.

B. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.

C. Sand lightly between succeeding enamel or varnish coats.

D. Apply each material at not less than the manufacturer's recommended spreading rate, to provide a total dry film to thickness as recommended by manufacturer.

E. Prime Coats: Apply prime coat on material, which is required to be painted or finished, and which has not been prime coated by others.

1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 FIELD QUALITY CONTROL

A. Each applied coat of material must be inspected and approved by the Architect before the application of the succeeding coat, otherwise no credit for the coat applied shall be given, and the contractor automatically assumes the responsibility to recoat the work in question.

1. To comply with the above, the painting contractor shall notify the Architect when each coat is completed.

3.06 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. 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 and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to Architect.

D. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

E. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

SECTION 220519 - METERS AND GAUGES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. All items in this section under Part 2 - Products.

PART 2 - PRODUCTS

2.01 THERMOMETERS

A. Provide where shown on drawings or called for in specifications.

B. Acceptable Manufacturers: Ashcroft and Weiss.

C. TH-1: Weiss bi-metal type dial thermometer 5" Vari-Angle #5VBM 2 ½" stem length. Adjustable connection location 1/2" NPT connection. Scale calibrated in 2° divisions from 0°F to 250°F. Provide with thermowell to match stem length as required.

2.02 PRESSURE GAUGES

A. Provide where shown on drawings, called for in specifications, or where water services enter building.

B. Acceptable Manufacturers: Ashcroft and Weiss.

C. PG-1: Weiss 4CTSLF Liquid Filled 4.5" Diameter. 1% accuracy, ¼" or ½" NPT 0-200 PSI range. Provide with pressure snubbers and brass gage cocks.

PART 3 - EXECUTION

3.01 THERMOMETER INSTALLATION

A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

B. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with food grade oil and secure cap.

3.02 PRESSURE GAUGE INSTALLATION

A. Install pressure gauges in piping tee with pressure gauge valve located on pipe at most readable position.

B. Install in the following locations and elsewhere as indicated:

1. At suction and discharge at each pump.

2. At discharge at each pressure reducing valve.

3. At building water service entrance.

3.03 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges and factory finished surfaces. replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 220523 - VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. All valves other than design equipment.

B. Operating and Maintenance Instruction Manual and Parts List.

PART 2 - PRODUCTS

2.01 VALVES

A. General: Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.
2. Ball valves, stem packing, serviceable without removing valve from line.
3. All valves must comply with ANSI 372 for lead free plumbing products.

B. Make

1. Gate, globe and check valves: Walworth, Stockham, Milwaukee, Nibco.
2. Butterfly Valves: Nibco, Milwaukee, Stockham, Watts.
3. Ball valves: Nibco, Apollo, Milwaukee, Jomar.
4. Balancing valves: Calibrated manual balance valves with memory stop.
5. For convenience in designating type, design, etc., certain numbers are given hereinafter as "Design Equipment."

C. Valve Types:

1. Gate Valves: (Use only where indicated)
   a) 2" and Smaller: bronze, renewable seat, plug type, disc, union bonnet, rising stem, Class 200, screwed ends, Stockham Model #B-62.

   b) 2-1/2" and Larger: rising stem resilient wedge, OS&Y Class 150 flanged, 200 psi, non-shock water working pressure, epoxy coated body, Stockham Model #G610; Nibco Model #F-607-RW.

2. Globe Valves: (Use only where indicated)
   a) 2" and Smaller: Bronze, renewable seat teflon disc, union bonnet, rising stem, Class 150, screwed ends, Stockham Model #B22T.

   b) 2-1/2" and Larger: Bronze renewable seat teflon disc, rising stem, union bonnet, solder ends, Class 150, Stockham #B24T.

3. Check Valves:
   a) Spring checks and ball checks shall not be approved, unless otherwise specified.

   b) 2" and Smaller: Bronze body, TFE seat and disc., silent check, screwed ends, Class 125, Nibco Model #T-480-Y-LF, conforms to MSS SP-110, ANSI 372.

c) 2-1/2" and Larger: Wafer style, silent check, renewable seat and disc, spring activated, globe style, LB W.O.G., Nibco Model #W-910.

4. Butterfly Valves:
   a) 2-1/2" and Larger: Ductile iron body, extended neck, geometric drive, molded-in seat liner lug style EPDM liner and aluminum bronze disc., 200 psi rated, Nibco Model #LD200.

5. Balance Valves:
   a) Calibrated balance valve with provisions for connecting a portable differential pressure meter suitable as a service valve. Meter connections to have built-in check valves. An integral pointer shall register degree of valve openings. Valve shall have internal seals.

   b) Balance valves sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
½”	up to 2.5
¾”	2.5 - 4.5
1”	4.5 – 10

   c) Design equipment: B&G Circuit Setter Series.

6. Ball Valves:
   a) 2" and Smaller: Bronze body 2-piece full port with chrome plated bronze ball. TFE seats and seals, 600 psi WP, W.O.G. screwed ends; Nibco Model #T-685-80-LF, conforms to MSS SP-110, ANSI 372.

   b) 3” and Smaller: Bronze body 2-piece full port with chrome plated bronze ball. TFE seats and seals, UL Listed and designed as a safe shut off valve for LP gas, natural gas, flammable liquids and heated oil, blow-out proof stem design, screwed ends; Apollo Series 80-100.

   c) 4" and Smaller: Brass body 2-piece full port with stainless steel ball. TFE seats and seals, 600 psi WP, W.O.G., lead free, screwed ends; Raven Series L-610T.

7. Valves for Gauges, Instruments, etc.:
   a) 1/4" Size: Brass bar stock for 1000 psi and 300°F; Trerice #735 Needle Valve, or approved equal.

2.02 STRAINERS

A. 2" and Smaller: Bronze body, IPS connection, "Y" type, 20 mesh stainless steel screen, tapped bronze retainer cap for closure plug, bronze plug, 125 WSP. Watts 777S Series.

B. 2-1/2" and Larger: Iron body flanged "Y" type, ASTM #A-126, Class B, with blow-off connection, self-aligning 1/16" perforated stainless steel cylindrical screen. 125 psi WSP. Watts 77F Series.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide valves of type called for and where shown and/or specified, and where required to service equipment whether or not shown.

B. Provide at all major building or systems sections whether or not shown.

C. Install all valves with stems at or above horizontal positions and all swing check valves in horizontal position only.

D. Ball valves may be used in place of gate valves for water service through 2" size at contractor's option, unless otherwise noted.

E. Provide new valves (size to match existing) for any existing non-operational valves which are required to allow for new installations to be made.

F. Install thermostatic mixing valve in upright position, with thermal bulb as close as possible to the outlet of the valve. Install within cabinet where specified.

1. Install mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
2. Install thermometers and water regulators where indicated.
3. Install recessed or surface mounted cabinet units as indicated.
4. Consult factory’s manufacturer’s representative for initial start up.

3.02 PLUMBING SYSTEM

A. Install valves on all branch lines leaving mains and serving two fixtures or more; to isolate each piece of equipment or fixture, for future connections and where indicated.
B. Use balancing valves on domestic water re-circulation lines.

END OF SECTION

SECTION 220553 - PIPE IDENTIFICATION & VALVE TAGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including the General and Supplementary Conditions, apply to the work of this section.

1.02 IDENTIFICATION

A. Pipe Identification Markers: Furnish and install pipe identification markers on all piping installed under this contract, to consist of self-adhesive labels of black letters imprinted on color coded background indicating pipe fill and direction of flow. Lettering shall be 2" high on pipes 3" in diameter and over and 3/4" high on pipes under 3". Markers shall be applied to pipe, or to insulation in case of insulated pipes, on 15' centers, at branch take-offs and at each valve, whichever is closer.

B. Refer to schedule below for piping system, background color and lettering color.

C. Pipe Identification Schedule

	System I.D.	Background	Lettering
1.	Domestic Cold Water	Green	White
2.	Domestic Hot Water	Yellow	Black
3.	Sanitary Sewer	Green	White
4.	Storm Water Sewer	Green	White
5.	Sanitary Sewer Vent	Green	White
6.	Condensate Drainage	Yellow	Black

D. Equipment Nameplates and Valve Tags: Identify each valve, control entity or piece of equipment with stamped brass or engraved plastic nameplate permanently attached by riveting, wiring, etc. Set up complete identification system in accordance with Owner's Physical Plant Department. Each drain plug or valve shall be tagged "DRAIN". Embossed and/or pressure sensitive plastic tape labels shall not be acceptable. Furnish engraved 2" x 1" black rigid laminated plastic nameplate for each motor starter to EC for mounting. Furnish framed valve chart indicating valve number, location and usage for all valves installed under this contractor.

END OF SECTION

SECTION 220715 - INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. Manufacturer data for all materials used in Contract.
B. Submit schedule of insulation applications.
C. Samples, only when requested.

1.03 QUALIFICATIONS

A. Installation of thermal insulation shall be made by competent mechanics regularly employed by and under the direct supervision of a qualified, approved insulation subcontractor.

B. All materials shall be installed per manufacturer's written recommendations and specifications.

C. All insulation, jackets, adhesives, and coatings, unless specifically modified, shall comply with the following:

D. Any treatment of jackets or facings for flame and smoke safety must be permanent. Water soluble treatments prohibited.

E. Insulation, including finishes and adhesives on the exterior surfaces of ducts, pipes, and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less as determined by an independent testing laboratory in accordance with American Society for Testing and Materials Standard E 84, NFPA 255 and UL 723. Also, same shall comply with NFPA 90A, when installed in air plenums.

F. Work shall not commence until building is enclosed and roofs are watertight. Obtain approval from Architects before commencing work.

PART 2 - PRODUCTS

2.01 PIPE INSULATION (RIGID TYPE)

A. Pre-formed rigid sectional pipe covering, with factory applied jacket. Material, jacket type and thickness as specified hereinafter.

B. Insulation Material: Fiberglass.

C. Conductivity: Maximum thermal conductivity (k), on a flat surface, shall be 0.25 Btu/sq. ft. hr. °F/inch mean temperature.

D. Jackets: White Kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn permanently treated for fire and smoke safety and to prevent corrosion of the foil.

2.02 ACCEPTABLE MANUFACTURERS

A. Fiberglass: Johns-Manville, CGS, (Certainteed), Owens-Corning, Knauf.

B. Adhesives: Benjamin Foster or equivalent. Benjamin Foster (BF) numbers are used, unless otherwise noted, for convenience in designating quality of adhesive.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. "Concealed" is generally intended to mean Work within or behind various construction elements, either fixed or removable, or in crawl spaces or trenches, which are not exposed to view when project is complete.

B. "Exposed" is generally intended to mean anything exposed to view when project is complete; as opposed to "concealed."

C. Provide Thermal Insulation:

1. Insulation is required on all piping unless otherwise indicated on Contract Documents.

2. Only on clean, dry surfaces and after piping ductwork and equipment have been tested and found to be tight.

3. On cold surfaces with continuous unbroken vapor seal.

4. All exposed surfaces shall be white.

5. Pipes individually insulated.

6. Domestic cold water, hot water and hot water return piping-hanger installed around piping insulation. Provide insulation shields.

7. On Sanitary drains for fixtures accessible to the disabled.

8. On all roof drain bodies and storm water piping.

D. Miscellaneous:

1. Install insulation on exposed hot and cold plumbing piping to within 18" of fixture or equipment connection.

2. Insulate hot and cold piping longer than 18" located inside sink cabinets, under counters, under tables, etc.

3.02 PIPE INSULATION (RIGID TYPE)

A. Apply insulation on all systems piping including fittings, flanges, unions, strainers, and other miscellaneous attachments installed in piping system, whether exposed or concealed, except where omitted or specified to contrary.

B. Any piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness specified. Where in wall chases: In addition to the above, pack chase with loose glass fiber insulation.

C. Hanger Shields: Required on all piping.

D. Joints in Section Pipe Covering Made as follows:

1. Standard: Longitudinal laps and butt joint sealing strips cemented with BF 85-20 or Armstrong 520. May be stapled with outward clinching staples where concealed or recovered. Factory applied pressure sensitive adhesive lap seal may be used at contractor's option. Adhesive shall be in two strips -- one, applied to the longitudinal jacket and the other on the opposing jacket surface.

2. Vapor barrier: Provide for all cold services. Longitudinal laps and 4" vapor barrier strip at butt joints shall be sealed with white BF 85-20 or Armstrong 520. Seal ends of pipe insulation at valves, flanges, and fittings and at butt joint approximately every 21' with white BF 85-20.

E. Fittings, Valves and Flanges:

1. Concealed & Exposed: Premolded fitting covers of the same material and thickness as the adjacent pipe insulation and finished with glass cloth applied and coated with BF 30-36 "Seal-Fas".

2. Optional: In lieu of the standard method above, the Contractor has the option of using "Zeston" methods, or Ceel-Tite System provided:
   a) Appearance and workmanship are acceptable to the Architects.
   b) Insulation values at least as great as specified must be maintained.
   c) Application details and manufacturer specifications shall be followed and are hereby made a part of the Contract Documents.

3.03 PIPE INSULATION MATERIALS

A. Schedule of Piping Insulation:

Schedule of Piping Insulation

Service	Material	Insulation Thickness
Domestic Cold-Water	Glass Fiber	All Sizes – 1″
Domestic Hot Water	Glass Fiber	105-140 deg. F = 1″
		141-180 deg. F = 1.5″
Domestic Hot Water Recirculation Glass Fiber	Glass Fiber	105-140 deg. F = 1″
		141-180 deg. F = 1.5″
Roof Drains, Storm and Drainage Piping	Glass Fiber	All Sizes – 1/2″
Condensate Drainage Piping	Glass Fiber	All Sizes – 1/2″

B. Note: Jacket material, finish, fitting covers, etc. (for all piping) shall be as specified for "exposed" and/or "concealed" application. Color shall always be white unless specifically approved otherwise.

C. Insulation Covers for Piping and Pipe Fittings: Provide PVC (Zeston) type insulation covers for all exposed insulated pipe and pipe fittings, other than Mechanical Rooms. Cover shall be fastened with a vandal resistant system and as specified.

D. Cover system shall be installed from floor to ceilings, complete. In areas where a ceiling is not present cover system shall be provided from the floor to 10' 0" above finished floor.

END OF SECTION

SECTION 221116 - PIPING SYSTEMS & ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. All items specified in this section under Part 2 - Products.

PART 2 - PRODUCTS

2.01 GENERAL

A. All pipe and fittings new and marked with manufacturer's name; comply with applicable ASTM and ANSI Standards.

B. All water piping fittings must comply with ANSI 372 for lead free plumbing products.

2.02 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A-120 or ASTM A-106 seamless or ERW Schedule 40, or extra strong (Schedule 80) weight; black or galvanized finish as called for.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Cast iron fittings: Screwed connection, cast or malleable iron, black or galvanized; drainage type where called for.

C. Flanges, Unions and Couplings:

1. Screwed connections:
a) Unions: ASR malleable cast iron, bronze to iron seat, 300 lb. wwp; use for sizes 2" and smaller.

2. Gauge and Instrument Connections: All nipples, plugs, etc., for adapting gauges and instruments to piping system shall be IPS brass.

2.03 COPPER PIPE AND FITTINGS

A. Pipe: Hard temper, ASTM B-88; Type K, L, M, or DWV, as called for. Soft temper only in specific cases. Plans show copper tube sizes.

1. Copper is not allowed for urinal waste.

B. Tees, Elbows, Reducers: Wrought copper or cast bronze; solder end connections; ASTM B-62, ANSI B16.22. mechanical fittings ASTM B-88

C. Unions and Flanges: 2" and smaller use unions, solder type, cast bronze, ground joint, 150# swp; 2-1/2" and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 swp. Bolts shall be same as for steel pipe.

D. Press Fittings: Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, and the performance requirements of IAPMO PS117, and ICC LC1002. Press fittings 1/2-inch thru 4-inch for use with ASTM B88 copper tube type K, L, or M and 1/2-inch up to include 1-1/4-inch annealed copper tube. Press fittings shall have either an EPDM, FKM, or HNBR sealing element and integral detection feature intended to identify un-pressed fittings. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, EPDM or FKM sealing element and integral detection feature. Sealing elements shall be factory installed and shall be verified for the intended use.

1. Note: Only Press fittings with EPDM sealing element that conform to NSF 61-pw shall be installed in a potable water system.
2. Acceptable Manufacturers: Veiga ProPress, ApolloPRESS or Nibco.

2.04 SOIL PIPE AND FITTINGS

A. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

B. Pipe: ASTM A-74 service weight cast iron, coated.

C. Fittings: Service weight type with neoprene gasket of same manufacturer as piping, acceptable for piping buried only in earth.

D. No-Hub (Above Grade Only):

1. Pipe: ASTM C-564 no-hub cast iron, coated.
2. Fittings: Cast iron no-hub pattern with heavy-duty rubber gasket and stainless steel clamp assembly. Mission Rubber or equal. ASTM # 1540, ASTM C564.

2.05 DUCTILE IRON PIPE

A. All ductile iron pipe shall meet the latest ANSI Specification A21.51-76 thickness Class 52.

B. Pipe shall be full lengths of 18 ft. or longer with beveled and marked ends.

C. The class or nominal thickness, manufacturer's mark, year pipe produced and the letters D1 or Ductile shall be cast or stamped on pipe. Cast marks to be near bell portion of pipe.

D. Pipe shall have cement mortar lining in accordance with American-Standard Association Specification ASA A21.4-80 (AWWA-C10480). Pipe shall have a coating of coal tar pitch varnish on the outside.

E. Joint shall be a mechanical type joint. There shall be two (2) bronze wedges supplied for each joint of pipe, gasket, lubricant, retainer gland and bolts.

2.06 SPECIAL FITTINGS

A. Cast Iron to Lead Pipe:

1. Red brass ferrules and wiped joints.

2. Caulk ferrule into cast iron hub.

B. Copper to Steel Piping

1. Cast bronze copper to iron male or female adapter with shoulder.

2. Use dielectric pipe fittings where required.

C. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

D. No-Hub, or Cast Iron: Proper adapter to piping being connected.

2.07 DIELECTRIC PIPE FITTINGS

A. Tensile strength, Federal Specification WW-U-531A, union or flange design, 250 psi pressure rating, threaded or solder joint, constructed to prevent gasket from squeezing into internal opening.

B. Make: Epco or equivalent.

2.08 PVC SCHEDULE 40 PIPING

A. Pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D 1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded fittings shall conform to ASTM D 2665.

B. Fabricated fittings shall conform to ASTM F 1866. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements.

C. Solvent cements shall conform to ASTM D 2564. Primer shall conform to ASTM F 656. The system to be manufactured by Charlotte Pipe and Foundry Co. and is intended for non-pressure drainage applications where the temperature will not exceed 140 deg. F.

2.09 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps, Etc.: Carpenter & Patterson, Central Iron, Elcen, Fee & Mason, Grabler and Grinnell.

B. Hangers: Adjustable, steel clevis type, cadmium plated or galvanized except where in contact with copper piping. Copper plated or PVC coated where in contact with copper piping.

C. Hanger Shields: Required on all piping.

D. Spacing Schedule:

Pipe Size	Steel (ft)	PVC (ft.)	Copper (ft)	No-Hub Cast Iron *	Rod Size
3/4" to 1"	12	4	6	Each	3/8"
1-1/4" to 1-1/2"	12	4	6	Horizontal	3/8"
2" to 4"	12	4	10	Joint	1/2"
5" and Over	12	4	10	5 Feet	5/8"
8"	12	4	10	Maximum O.C.	3/4"

*Cast iron "No-Hub" to be supported on all sides of fittings & Joints

E. Piping systems with material not listed in above schedule shall be supported and protected in accordance with manufacturer's recommendations and as approved.

F. Inserts: Equal to Grinnell Fig. #281, maximum loading l000 lbs., galvanized finish, and Fig. #285, maximum loading 400 lbs. Use approved beam clamps if possible.

G. Supports:

1. For Weights Under 1000 lbs.: Support all Contract Work with approved type "Drill-In" inserts equal to "red Head," "unistrut," beam clamps or other structurally approved support. The factor of safety shall be at least four (4). Follow manufacturer's recommendations.

2. For Weights Above 1000 lbs.: Drill through floor slabs and provide flat flush plate bolted to top of rod or provide additional "Drill-In" inserts and hangers to reduce load per hanger below 1000 lbs.

3. For Metal Decks: Drill hole through for hanger rods and imbed a bolted plate in concrete or use Phillips "Red Head" devices designed for this application. All cases must have safety factor of four (4).

H. Trapeze Hangers:

1. Use for plumbing systems only.

2. Hangers shall be supported with rod size per above schedule.

3. May be "Kindorf" or Unistrut" manufactured type or suitable angle iron or channel.

4. Securely fasten to trapeze with "U" bolt or straps, dissimilar metals shall not touch, otherwise use isolation gaskets.

2.10 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast iron polished chrome, split hinge type with setscrew, when used at ceiling and floor locations. Special high plates where required for extended sleeves. Chrome plated in vicinity of all fixtures. Provide escutcheons at all pipe penetrations thru ceilings, floors and walls exposed to view.

2.11 SLEEVES

A. Standard Type: Schedule 40 black steel pipe sleeves, two pipe sizes larger than the pipe, required for all structural surfaces.

B. Sheet metal sleeves permitted only for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and shall be properly braced to prevent collapsing.

2.12 SEALING ELEMENTS

A. Waterproof Type: Synthetic rubber material with zinc plated bolts equal to "Link-Seal" Series 200, 300 or 400.

2.13 PIPING MATERIALS (PLUMBING)

A. Water Distribution Piping:

1. Copper tubing Type “L” ASTM B75, ASTM B88, ASTM B251, ASTM B 447. Lead-free soldered joints or mechanical joints.

B. Above Grade Drainage & Vent Piping:

1. Cast-iron soil piping with no-hub connections ASTM A74, ASTM A888.

C. Below Grade Drainage & Vent Piping:

1. Cast-iron soil pipe, hub & spigot fittings with neoprene gaskets. Compression type connections ASTM A74, ASTM A888.

D. Above Grade Storm Piping:

1. Cast-iron soil piping with no-hub connections ASTM A74.

E. Below Grade Storm Piping:

1. Cast-iron soil pipe, hub & spigot fittings with neoprene gaskets. Compression type connections ASTM A74, ASTM A888.

F. Condensate Piping:

1. Pipe material to be Schedule 40 PVC piping with solvent weld fittings.

PART 3 - EXECUTION

3.01 EQUIPMENT AND SYSTEMS

A. All equipment and systems as shown on the drawings or specified herein shall be installed in accordance with the provisions of each applicable section of these Specifications and all local and state codes and regulations having jurisdiction.

B. All work shall be installed in a workmanlike manner as determined by Architects.

C. Accurately establish grade and elevation of all piping before setting sleeves. Install piping without springing or forcing (except where specifically called for), making proper allowance for expansion and anchoring. Arrange piping at equipment with necessary offsets, unions, flanges, valves, to allow for easy part removal and maintenance, as approved.

D. Offset piping and change elevation as required to coordinate with all other trades.

E. Avoid contact with any part of other mechanical or electrical systems.

F. Provide adequate means of draining and venting all units, risers, circuits and systems.

G. Conceal all piping unless otherwise specified.

H. Install piping and connections approximately as indicated or directed, straight, plumb, direct, parallel and close to building walls, partitions, ceiling, in general, with groups of pipes parallel to each other and close to structural members allowing for insulation and access for servicing valves, etc. Horizontal piping to be installed as high as possible without sags.

I. Coordination with other trades: Check Contract Drawings with all others, anticipate and avoid interference with other installations. Obtain decision or approval from Architect for proposed group installation and before proceeding, and for clearances in structure and finish.

J. Fixture branches exposed only as required for final connections.

K. Over Electrical Equipment: Prohibited. Special cases may be permitted with approval of Architect, protecting copper drip pan.

L. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make all changes in direction and branch connections with approved fittings. All cleanout plugs, bushings and nipples, required for gauge and instrument installation shall be brass. Do not install valves, unions and flanges in inaccessible locations.

M. Materials used within a system and between systems shall be consistent. If this is not possible, install approved dielectric fittings.

3.02 HANGERS, INSERTS AND SUPPORTS

A. No piping shall be supported by wires, band iron, chains, or from other piping, nor by vertical expansion bolts. Support piping with individual hangers from concrete inserts, approved welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Always obtain approval.

B. Suspend with rods of sufficient length for swing and of size as previously scheduled, using four (4) nuts per rod. Use rods and nuts having electroplated zinc or cadmium (0.005" minimum) finish.

C. Provide additional approved structural steel members, having one coat rustproof paint, where required for proper support.

D. Provide oversized hangers where insulation/supports must pass between pipe and hanger.

E. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible; “C" type not permitted.

F. Riser Clamps: Provide riser clamps for each riser at each floor. Allow for escutcheon plates.

3.03 PIPE CONNECTIONS

A. Solder Connections: Use only 95/5 nonacid flux and clean off excess flux. Also remove excess solder from piping.

B. Threaded Connections: For steel pipe and brass pipe. Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be approved for application.

C. Dielectric Pipe Fittings: Protect fittings from excessive heat.

3.04 SLEEVES

A. All underground pipes and conduits, regardless of their contents, shall be provided with sleeves at the foundation wall and shall be sealed at the section of entry into the building with a material that will form a gas-proof barrier.

B. Provide for all pipes passing through floors, walls or ceilings.

1. Standard type: Provide for all piping, except as specified above.

C. Extend l/8" above floor in all finished areas except those with floor drains or in Penthouse; use steel pipe sleeves 2" above floor in excepted areas. Use steel pipe sleeves in all bearing walls, structural slabs, beams and all other structural surfaces, and where specifically called for.

D. Sleeves, where installed in walls of shafts, shall be as small as practical, consistent with insulation, etc., so as to preserve fire rating of shaft walls.

E. Fill abandoned sleeves with concrete.

F. Where floors are membrane waterproofed, use flashing clamp device on sleeves equivalent to Josam Series 1880 "Riser Sleeve".

3.05 ESCUTCHEON PLATES

A. Provide polished chrome escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except Mechanical Rooms.

B. Cut plates if necessary to fit conditions.

3.06 SLEEVE PACKING

A. Tightly seal void space at all sleeves throughout building as follows:

1. Interior locations: Firmly pack with fiberglass, the space between sleeve and pipe, then neatly caulk with caulking gun and approved material.
2. Exterior walls above grade: Use sealing element.
3. Exterior walls below grade: Use sealing element.
4. Cored holes: Method shall be approved or use sealing element.
5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods.
6. Waterproofed floors without membrane: Use Architects' approved sealing element, device or compound.
7. Waterproofed floors with membrane: Use Architects' approved sealing element, device or compound.

3.07 TESTS

A. Refer to Section 220010 for testing of plumbing systems.

3.08 PIPE LINE SIZING

A. Pipe sizes indicated on Contract Documents are to be maintained. Pipe size changes made only as approved by Engineer, or required by State or local codes.

B. Where discrepancy in size occurs, the larger size shall prevail, unless otherwise directed by the Architects.

3.09 TRAPEZE HANGERS

A. Use where groups of piping can be installed easily. Hangers are to be sized in accordance with loads imposed.

END OF SECTION

SECTION 221127 - WATER SUPPLY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. All items specified under Part 2 - Products of this Section, including pipe and fittings.

PART 2 - PRODUCTS

2.01 WATER PIPING

A. Refer to Section 221116 - Piping Systems and Accessories; for acceptable materials.

2.02 DISINFECTION

A. The Contractor shall disinfect the entire hot and cold water system. This shall include all hot water circulation piping and connecting supply mains. Renovations to existing piping systems shall be isolated with new valves by Contractor for testing of new system only.

B. Use the purging and disinfecting procedure proscribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below.

C. A chlorine solution shall be injected into and circulated through the entire hot and cold water system. Operate all hot and cold water faucets, flush valves, mixing valves and metering valves. Duct tape all metering valves to hold in on position. Continue flow of water from system until a determined uniform chlorine count of 50 ppm is reached. Then shut off all flow and let systems stand full.

D. Tube test samples of hot and cold water in each fixture area every 8 hours to determine chlorine residual content.

E. If the chlorine residual content drop is more than 10% in any 24 hour period, system must be injected with additional chlorine and Step A repeated. This shall continue until a 95% chlorine residual level remains over 24 hours.

F. After the system test has been accepted by the Architect or Engineer, the entire system shall be drained and refilled. It is important that if the building has a septic system all water must be drained on to paved areas of parking lots. The Contractor shall install all necessary valves at low points and furnish any pumps and drain piping to accomplish this.

G. Prior to final test, the system should be flushed through plumbing fixtures until any concentrated chlorine odor is undetectable.

H. A final test of both hot and cold water shall be taken at the furthest point of the system by a certified testing agency. Full bacteria and metals test shall be performed to verify the water meets all potable drinking water standards.

PART 3 - EXECUTION

3.01 PIPING

A. Run slightly off level to low points; provide drain valves.

B. Provide shock arrestors where shown, or specified.

C. Branch headers serving flush valves; full size as shown.

D. Provide dielectric pipe fittings when connecting to piping system of dissimilar metals.

E. Supply piping to all fixtures, faucets and flush valves shall be anchored to prevent movement.

F. Provide and install necessary wood or metal backing material to secure piping, flush valves, faucets, etc.

G. Piping shall be run to avoid all electrical panels and equipment.

END OF SECTION

SECTION 221130 - EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. All items specified in this Section under Part 2 - Products.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS AND FLOOR SINKS

A. Acceptable Manufacturers: Jay R. Smith, Josam, Zurn or Wade.

B. FD-1: Zurn #ZN-415 floor drain, dura coated cast iron body with bottom outlet. Combination membrane clamp and adjustable collar. 5" polished brass nickel bronze round top. Provide with Rector-Seal Sure-Seal Trap Guard

2.02 CLEANOUTS

A. Acceptable Manufacturers: Jay R. Smith, Josam, Zurn or Wade.

B. FCO-1: Zurn #ZN-1400 level-trol adjustable floor cleanout D.C.C.I. body with polished nickel bronze scoriated top, gas and water tight. ABS tapered thread plug and scoriated round top adjustable to finished floor

C. WCO: Zurn #Z-1446 cleanout with round stainless-steel wall access cover.

D. BCO: Zurn #1445 cleanout tee.

2.03 ACCESS DOORS

A. AD-1: Zurn ZANB-1462-VP square smooth nickel bronze wall access panel and frame 10"x10" with beveled edge and anchor lugs for over wall installation. Provide with vandal proof secured top.

2.04 SHOCK ARRESTORS

A. Provide where shown on drawings and of size indicated.

B. Must meet or exceed requirements of the Plumbing and Drainage Institute Standard - PDI-WH 201.

C. Make: Watt's LF 15 MZ, male I.P.S. inlet.

2.05 THERMOMETERS

A. Provide where shown on drawings or called for in specifications. See Specification Section 220519 - Meters and Gauges, for requirements.

2.06 PRESSURE GAUGES

A. Provide where shown on drawings or called for in specifications, and where water service enters building. See Specification Section 220519 - Meters and Gauges, for requirements.

2.07 LINK SEALS

A. As manufactured by Thunderline Co. select style and links to suit type of piping to be sealed.

PART 3 - EXECUTION

3.01 WALL HYDRANTS

A. Install minimum 24" above grade.

3.02 SHOCK ARRESTORS

A. Install in vertical position and at accessible locations for maintenance.

3.03 CLEANOUTS

A. Install cleanouts out of traffic patterns; provide offset from unnecessary stress on basin at these points.

B. Do not locate under doors or under equipment, or behind cabinets.

3.04 ACCESS DOORS

A. Install access doors to provide access to shock arrestors. Coordinate location to avoid toilet partitions, grab bars, flush valves, etc. Install access doors flush and plumb with wall.

3.05 LINK SEALS

A. Install on piping at exterior and interior wall surfaces.

END OF SECTION

SLSECTION 224240 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specifications Sections, apply to the work of this section.

1.02 QUALITY ASSURANCE

A. All fixtures and trim must be on the "approved" list of the New York State Department of Environmental Conservation.

B. The materials specified shall meet or exceed the applicable requirements of FSWW-P-541.

C. Each fixture and fitting shall be plainly and permanently marked with the manufacturer's name or trade mark.

1.03 SUBMITTALS

A. Product catalog cuts, manufacturer's specifications, roughing dimensions, installation instructions and maintenance data. Manufacturer shall furnish proof that fixture, faucet, valve, shower head, etc. is approved and meets latest New York State Department of Environmental Conservation Standards.

B. Maintenance Tools: Deliver to Owner's representative.

C. Keys for fixture stops.

1.04 MATERIALS (GENERAL)

A. Vitreous China: 1st quality, smooth, uniform color and texture and having a fused-on glaze covering on all exposed surfaces free from chips, craze, warpage, cracks and discoloration.

B. Porcelain Enameled Cast Iron or Steel: Smooth, uniform color and texture, having a fused-on glaze covering on all exposed surfaces. Material shall show no cracks, chips, craze or discolorations. Enameled surfaces shall be acid resistant.

C. All faucets, shut-off stops and supply risers must comply with ANSI 372 for lead free plumbing products.

D. All toilet seats shall be commercial grade heavy duty plastic.

PART 2 - PRODUCTS

2.01 WATER CLOSETS

A. WC-1: See Plumbing Fixture Schedule.

B. WC-2: See Plumbing Fixture Schedule.

2.02 LAVATORIES

A. L-1: See Plumbing Fixture Schedule.
B. L-2: See Plumbing Fixture Schedule.

2.03 DRINKING FOUNTAIN

A. DF-1: See Plumbing Fixture Schedule.

2.04 MOP BASINS

A. MB-1: See Plumbing Fixture Schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Installation work of this section in strict accordance with the manufacturer's printed installation instructions and approved shop drawings.

2. Install fixtures level at heights indicated in specification; tighten all connections, install hold down bolts, cap nuts and cover plates where required.

3. Flush valves and wall faucets must be coordinated with ADA requirements for location and elevation. Secure with concealed fastening to assure that they cannot be pulled away from the wall surface.

B. Water Closets:

1. Locate handicapped flush valve handle on wide side of fixture.

2. Set bearing nuts to position the fixture 1/16" clear of the finished wall; caulk this space with white silicone based caulking sealant and strike a neat joint.

3. Install cap nuts and washers after all connections are tightened on floor mounted closets.

4. Caulk water closet at the floor line with white silicone based caulk.

C. Lavatories:

1. Set faucets and strainer in bed of plumber's putty and tighten to fixture.
2. Caulk countertop fixtures with clear silicone based sealant at juncture of countertop.

3. For wall mounted lavatories caulk with white silicone based sealant at junction to wall.

4. Set fixture level and plumb.

D. Service Sinks & Mop Basins:

1. Set the receptor level, make lead caulk connection from drain pipe to receptor drain.

2. Waterproof all joints between receptor and wall with clear silicone based caulking sealant.

E. Drinking Fountain/Electric Water Cooler: Anchor securely to wall as recommended by manufacturer.

3.02 CLEANING FLUSHING AND ADJUSTMENT

A. Clean fixture and trim. Remove grease and dirt.

B. Flush supply piping and traps, clean strainers and aerators. Remove vandal proof aerator installation device.

C. Adjust stops, flush tanks and flush valves for proper delivery.

END OF SECTION

DIVISION 23
MECHANICAL SPECIFICATIONS (HC)
INDEX

SECTION	TITLE
230005	MECHANICAL WORK GENERAL
230010	CONCRETE WORK
230523	PIPING SYSTEM VALVES
230593	TESTING, ADJUSTING AND BALANCING
230713	DUCTWORK INSULATION
230719	PIPING INSULATION
230993	TEMPERATURE CONTROLS
232100	WATER SYSTEM SPECIALTIES & EQUIPMENT
232113	PIPING SYSTEMS & ACCESSORIES
232300	REFRIGERATION PIPING & SPECIALTIES
233300	DUCTWORK ACCESSORIES
233310	DUCTWORK HANGERS AND SUPPORTS
233330	LOW VELOCITY DUCTWORK
233340	PREFABRICATED DUCTWORK
233710	LOUVERS
233713	DIFFUSERS, REGISTERS AND GRILLES
237223.1	INDOOR FIXED PLATE ENERGY RECOVERY UNITS
237510	VARIABLE REFRIGERANT FLOW SYSTEM
238215	DUCT MOUNTED COILS
238239.13	CABINET UNIT HEATER

SECTION 230005 - MECHANICAL WORK GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

1.02 ALLOWANCES, ALTERNATES AND UNIT PRICES

A. Refer to Division 1 specifications for allowances, alternates and unit prices required as part of this Contract.

1.03 INTENT

A. The intent of the drawings and these specifications is to provide all systems complete and operative. Whether indicated on the drawings and/or included in the specification or not, provide all materials, equipment and labor usually furnished with such systems.

1.04 DEFINITIONS

A. Provide: Furnish, install and connect.
B. Furnish: Supply material only.
C. EXR: Existing to remain.
D. MC: Mechanical Contractor-note MC and HC (Heating Contractor) shall be interchangeable for all drawings and specifications.

1.05 SCOPE OF WORK

A. This Contractor shall do all work, furnish all labor, tools and equipment necessary for all the MECHANICAL work all as indicated on the drawings and specified herein.

1. Removal of existing equipment as indicated on drawings.
2. All cutting and patching.
3. Variable refrigerant system, complete with all accessories.
4. Air cooled condenser units.
5. Fan coil units.
6. Cabinet unit heaters, complete with piping, controls, supports and accessories.
7. Duct coils, complete with installation accessories.
8. Pipe fittings, hangers, supports, valves, and piping specialties as required to make complete heating system.
9. Refrigeration piping, fittings, valves, etc.
10. All diffusers, registers and grilles complete with accessories.
11. All louvers provided by Contractor.
12. Galvanized ductwork (or specialty ductwork where noted) to serve supply, relief and exhaust systems complete with control devices and accessories, unless otherwise noted.
13. Insulation both thermal and acoustical to serve piping, ductwork systems, equipment, housings and accessories.
14. Temperature control system complete to serve all MECHANICAL equipment and systems complete with accessories.

15. Testing and balancing of all heating, ventilating and air conditioning installations to include sheetmetal ductwork, air conditioning supply and exhaust systems, heating and cooling systems and temperature control system. Balancing shall include NC ratings as described herein.
16. Special testing and balancing requirements for existing MECHANICAL equipment to include repair of existing equipment as required to obtain air flow as indicated on drawings.
17. Servicing of heating, ventilating and air conditioning facilities are required for guarantee period. Provide competent factory trained men at site for purpose of instructing Owner's personnel in proper operation and maintenance of all new MECHANICAL facilities.
18. Concrete pads, 4" high unless otherwise noted on drawings, to provide housekeeping elevation for boilers, pumps and such other equipment as shown on drawings that require a pad. Coordinate installation of pads with GC to insure secure bonding of pads to floor structure. This contractor shall be responsible for installation of pads.
19. Temporary heat as required by Architect's Special Conditions.

1.06 TEMPORARY SERVICES

A. Temporary Heat: In accordance with Architect's specifications and/or conditions, contractor shall have the permanent heating system capable of providing heat to the new work areas when required. The term heating system shall include all work or components necessary to operate heating system. For temporary usage, it is not required that this work be in a finished condition, i.e., covers in place, etc. Cost of fuel consumed for temporary heat from permanent systems only shall be paid by owner.

B. The use of permanent system will be allowed only if the building is fully enclosed with no construction dust to clog heating/cooling coils, heat recovery components, fans, etc.

C. At the completion of work, Contractor shall turn over to the Owner all equipment used for temporary heat in a new, as purchased condition. Contractor shall replace filters with new ones, clean all components which shall include: unit casings, ductwork, grilles, diffusers, etc., re-lubricate all moving parts, replace belts if required and perform any other work necessary (as determined by Architect and Engineer) to put equipment in a "new" condition.

D. Contractor shall take all measures necessary to insure that dust, dirt, or debris does not enter air systems while in operation for temporary heat and shall change filters as often as necessary. Under no circumstances shall air handlers be allowed to operate with no filter in place. All duct in the work area shall be sealed so no dust or debris will enter duct.

1.07 CONTINUITY OF UTILITY SERVICES

A. It is of paramount importance that each utility service operate continuously and without interruption. Whenever this contractor plans to make changes or alterations to any existing utility service, such plans shall result in no or minimum service interruption or inconvenience to Owner. This contractor shall plan and schedule any change or alteration to an existing utility service with Architect and Owner. Such planning, timing, and/or scheduling shall be approved by both these parties.

1.08 CODES AND STANDARDS

A. All materials, equipment, and installations by this contract shall be in accordance with the latest editions of the following applicable requirements:

1. 2020 New York State Building Code, including all applicable amendments supplements to the following:
   a) 2020 International Building Code

b) 2020 International Existing Building Code
c) 2020 International Fire Code
d) 2020 International Plumbing Code
e) 2020 International Mechanical Code
f) 2020 International Fuel Gas Code

2. 2020 Supplement to the New York State Energy Conservation Construction Code, including all applicable amendments to the following:
   a) 2020 International Energy Conservation Code
   b) 2013 ASHRAE 90.1

3. 2020 Uniform Code Supplement (May 12, 2020)

4. New York State Department of Environmental Conservation.

5. Conform to requirements of NEMA.

6. Bear label of Underwriters Laboratories, Inc.

7. National Electrical Code NFPA Article 70, latest edition.

8. New York State Health Code.

9. Local Utility Standards.

10. Local Municipal and/or city standards.

11. ASHRAE Standard 15.

12. Conform with applicable requirements of ASTM - Regulations and Standards for Pipe and Pipe Fittings.

13. Be in accordance with USAS - Code for Pressure Piping, latest edition.

14. For external and internal duct insulations, have flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with ASTM Standard E84.

15. Sheetmetal and Air Conditioning Contractor's National Association, Inc. (SMACNA), latest editions.

16. Conform with applicable requirements of Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA 90A, and Code for Safety to Life from Fire in Buildings and Structures, NFPA 101.

17. Conform to requirements of ASHRAE 90.1, latest edition.

18. Be in accordance with design standards outlined in ASHRAE Handbooks, latest edition.

19. Conform to requirements of Owner's insurance carriers.

1.09 SUBMITTALS & SUBMISSION REQUIREMENTS

A. All submittals shall be in accordance with Division 1 requirements, the following requirements listed below, and also as indicated in each specification section. All submittals not complying with the listing above will be returned to the contractor without being reviewed. Rejection by Architect or Engineer of any items submitted shall require resubmittal of acceptable items.

1. Within (20) days after receiving notice to proceed, submit to Architect for review complete descriptive dimensional data and ratings for equipment and materials proposed to be furnished and installed.

2. All materials submitted shall clearly state the job name and specification section(s) that it applies to.

3. Any package containing more than one piece of equipment or material shall also contain a schedule clearly listing all items in submittal. Schedule page (s) shall also indicate project name and building name.

4. All submittals must be clearly marked using nomenclature used in this specification for proper item identification, schedule of usages, model numbers, construction materials, performance, data, etc.

5. Projects involving multiple buildings must have the submittals separated by building. Submittals in which buildings are combined will not be accepted. (Exception: When specifically approved by engineer, basic materials may be submitted once.)

6. The contractor shall insure that dimensions of equipment to be used conform to the space allocated for the equipment on the drawings.

7. Submittals traced or copied from contract drawings are not acceptable and will be returned without review.

8. In the event material and/or equipment is installed prior to obtaining approval of shop drawings, and in the sole opinion of the Owner's Agent, this material and/or equipment does not meet the specifications, the Contractor shall be liable for the removal and the replacement at no additional cost to the contract.

B. Samples: When requested by Engineer, provide samples of both specified equipment and proposed substitutions for review by the Owner's Agent. Such equipment shall be delivered to a location designated, or erected at the job site as directed. When neither is physically possible, arrange for the Owner's Agent to visit an acceptable site where the proposed equipment can be inspected.

C. Substitutions (where allowed within the project):

1. After bid award if there are any units/piping/equipment the contractor would seek to substitute on, they must indicate in writing the specific equipment.

2. All substitutions shall be clearly highlighted, and in bold print, on the front cover of any submittal that it is a substitution.

3. Substitutions received after 45 days will not be considered.

4. Supporting documentation shall be provided describing why the item is an equal and listing the major difference.

5. Submittals for equipment or materials other than as specified shall be accepted for review by the Owner's agent.

6. Any substitution should be sent in as an RFI and reviewed prior to bid for acceptance. If the unit is submitted after the bid date, the submittal may be rejected without review.

7. Approval of substitute equipment shall be based on performance, dimensional, functional, physical and aesthetic compatibility to the equipment specified as determined by the Owner's agent and approved by the engineer. Any substitution shall meet any scheduled performance and characteristics noted within its particular specification section.

8. Where substitute equipment is approved, the contractor shall be responsible for, and bear the cost of any necessary changes by his trade or other trades to make the system complete and operable, including but not limited to any design fees and structural or steel changes required to implement a substituted unit.

9. Contractor is fully responsible for providing coordination between all trades affected by equipment substitution.

10. When requested, contractor shall submit layout drawings indicating new dimensions and arrangements of substituted equipment. Layout drawings shall indicate all revisions necessary for all services affected by substitution.

1.10 SUBSTANTIAL COMPLETION REQUEST FOR PUNCH LIST

A. Contractor shall submit a letter in email form stating that the work is substantially complete and ready for Punch List review by Engineer.

B. Contractor shall note which areas are substantially complete by Building (if multiple buildings) and by Area according to the Key Plan.

C. Contractor shall list all items that are known to be incomplete at time of submission.

D. If the request is for a partial Punch List, Contractor shall also include a list of room numbers/room tags.

E. When letter is received by the Engineer, site review(s) will be coordinated with the Construction Manager, Clerk, Architect.

1.11 CUTTING AND PATCHING

A. This contractor shall bear the cost of all cutting and patching required by and for the installation of this work. This contractor shall perform all cutting and patching unless otherwise indicated on drawings or if directed by the Architect.

B. Patching of fire rated floors, walls, partitions, etc. shall be made using new materials equal to the fire rating of the existing.

C. Should changes, omissions or errors in this contractor's work require cutting, patching or making alterations in any portion of new construction, such work will be performed by GC at contractor's expense.

D. Cutting and patching of roof surfaces and structures shall only be performed by a qualified contractor, as approved by the Architect. The work of this contract shall bear the cost of above mentioned cutting and patching. This contractor shall insure that existing roof warranties remain in force.

E. This contractor shall furnish lintels, sized to accommodate structure above opening, where cutting and patching is to be performed on load bearing walls. Contractor shall obtain written approval for all lintels prior to installation.

F. Cutting shall be done in a manner which will not adversely affect the strength of the building. Holes and openings shall be neatly cut so as to provide a finished appearance and shall be patched around the edge where required for a finished appearance. Provide temporary bracing, shoring, etc. as required.

G. Patching shall be structurally sound and match the existing materials and finish of adjacent materials. Patching is required in finished areas, wherever existing work is removed, at the sides of openings, etc.

H. At the completion of the work, all evidence of alteration will be as inconspicuous as possible.

I. If the MC has a duct or pipe going through a wall where the GC made an opening for the MC, the MC shall be responsible to infill the space between the duct/pipe and wall. Also refer to section 1.22 Penetrations through fire rated construction.

1.12 FIELD INSPECTION

A. As there are various conditions at the site which do not show on the accompanying drawings, or which are at variance with the conditions indicated on the drawings, it is important that each bidder visit the site and acquaint himself with existing conditions, and take these conditions into consideration when preparing his proposal. Each bidder shall obtain information or make any measurement desired. Lack of knowledge relative to existing conditions will not be allowed as a basis for extra compensation.

B. This contractor and his subcontractors shall inspect existing equipment to remain prior to any of his new work in order to determine that all equipment is in good operating condition. If equipment is found to be lacking components, is inoperable, damaged, etc., contractor shall provide immediate written notice to the Owner. The Owner or his representative shall determine if any additional work is necessary and the method by which any work shall be performed.

1.13 INSTRUCTION SERVICES AND MANUALS

A. Instructions:

1. Provide competent personnel to remain at the jobsite for necessary time to instruct the Owner's personnel in proper operation and maintenance of installation made by this contractor.

2. This contractor shall be responsible for notifying and instructing Owner's personnel on all equipment operations, maintenance requirements, etc. Furnish operating training session(s) for equipment listed.

3. The Owner shall be responsible for establishing an operating and maintenance program for all equipment listed.

B. Training Session: A training session shall be held for each system and/or item listed below: (Note: For Temperature Controls refer to Temperature Control Sections for training requirements.)

Item	Description	Training Hours For Each Bldg
1.	VRFC system	8
2.	ERV	2
3.	EDHC	2

C. The instruction shall include the following types of information:

1. System overview
2. Major component designation
3. System operation procedures
4. Maintenance scheduling and procedures
5. Provide a list of spare components each system would normally require

D. Services: Provide services required, for all equipment specified under this contract, for a period of (1) year after written acceptance by the Owner.

E. Manuals: Submit (3) sets of Operation and Maintenance manuals. Each set shall contain the manufacturers' data, operating instruction parts catalog and maintenance procedures for each piece of equipment. Include normal maintenance servicing schedule to be performed by the Owner.

1. For projects containing multiple buildings, manuals shall be submitted separately for each building.

1.14 PERMITS, CERTIFICATES AND FEES

A. This Contractor shall obtain and pay for permits, certificates, fees etc. listed below and as required. Costs for permits, fees etc. shall be included in the base bid amount.

1. All required applications and permits to begin work
2. Certificate of inspection including Third-Party Agency.
3. All municipal connection charges
4. All local utility charges (power, telephone, cable, etc.)
5. Fees and charges shall be obtained directly from the respective authority having jurisdiction
6. Fees and charges for hazardous waste hauling as required by DOT, DEC, etc.

1.15 REMOVAL, DISPOSAL AND HAZARDOUS MATERIALS

A. All removed equipment shall be removed from the site and properly disposed of.

B. All hazardous materials must be disposed of in compliance with ENCON and all other regulatory agencies. The contractor shall provide the owner with written chain of custody reports and final destination of disposal.

C. The Owner may wish to keep certain equipment, therefore, check with Owner before removals to determine what may be salvageable.

D. Unless otherwise noted, all equipment to be removed shall have all accessories and supports removed with it, whether indicated or not. In addition, any refrigeration containing equipment that is shown for removal shall have all refrigerant evacuated from the system and properly disposed of and all refrigerant piping removed from the site. Refrigerant recovery shall be performed by a technician certified in the maintenance, service, repair, and disposal of refrigerant containing equipment per EPA.

E. Any equipment, piping or ductwork that has been removed in the project and has left an opening and/or anchor points in a floor, wall or roof shall have the openings and voids infilled to match existing conditions.

1.16 GUARANTEE

A. Contractor shall guarantee all work furnished through this contract including work performed by sub-contractors, for a period of (1) year (unless otherwise noted), from the date of final acceptance. Contractor agrees to repair or replace any defective work or materials at no additional cost to the Owner. Contractor shall also pay for any damage to other work resulting from repairs to defects. Contractor shall furnish written guarantees to the Owner's agent in accordance with the general conditions.

1.17 INSTALLATION

A. This contractor shall coordinate scheduling and installation of work with other contractors, sub-contractors and other trades. The contractor is also required to coordinate all work with owner supplied materials, direct contracts, and normal building operations, if any.

B. All finished work shall be neat and workmanlike. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade. New systems shall be delivered to Owner complete in perfect working order, tested and balanced in full accordance with plans and specifications. Existing systems shall function in same manner as before this work was performed. Any malfunctions which arise in existing systems as a result of demolition or alteration of parts of such systems shall be corrected.

C. Layout of equipment, accessories and piping systems in plan is generally diagrammatic unless specifically dimensioned or detailed. Check project drawings and existing site conditions before installing work for interference's as governed by structural or other conditions. Owner reserves the right to make reasonable changes in location of equipment, accessories or piping systems prior to "roughing-in" without involving additional expense. Exact dimensions shown upon plans will be subject to verification and confirmation of exact conditions at site at time of construction. "Plus or minus" dimensions are shown upon drawing as a guide only. Exact surrounding conditions are governed by final equipment selection and/or other like details.

D. Furnish all new equipment and materials as described herein. Any material, operation, method or device mentioned, listed or noted within this specification, if not specifically mentioned as furnished or installed by others, shall be furnished and installed by this contractor.

1.18 STORAGE OF MATERIALS

A. For all ductwork, piping and insulation brought to the jobsite, it shall be protected from all environmental elements. This shall include, but not limited to, water, dust, chemicals and other hazardous materials. It shall be stored within a protected area in the building.

B. All ductwork onsite shall have a wrap on it to prevent the duct from having any dust, debris or other hazardous materials from becoming adhered to the interior of the duct. No duct may be stored where it could be rained on. Also refer to section 233330, low velocity ductwork, for additional information.

C. All insulation on the jobsite will be stored in an area that will protect it from weather damage.

1.19 START UP

A. A start up shall be performed for all new MECHANICAL equipment (MECHANICAL equipment shall be defined here as any MECHANICAL unit that requires power or a temperature controls connection). The manufacturers representative will be onsite and unit operation will be verified, including but not limited to air flow, heating and cooling setpoints are attained and unit functions within manufacturers parameters. A written report shall be furnished to the architect.

1.20 TESTING AND INSPECTION

A. Inspections required for any ordinances, regulations, instructions, laws, rules, standards and practices that require any work to be inspected or tested shall be performed. Contractor shall give Owner, Architect and Engineer timely notice of readiness of work for inspection or testing and the date fixed for said inspection or testing.

B. Third-Party Agency must inspect completed installation and present Owner with Certificate of Inspection showing approval.

C. Required local or municipal inspection processed and present Owner with certificate indicating approval of such governing bodies.

D. Contractor shall submit a written report to Architect, copy to Engineer, on results of each inspection or test on system or equipment supplied. Report shall contain all pertinent information, recommendations, approvals, additional work required, etc.

1.21 RECORD DOCUMENTS

A. When required by general conditions or other Division 1 Section, this Contractor shall prepare and turn over to Owner's agent record As-built documents. As-built drawings will include actual equipment location layout, service connections, ductwork and piping layouts, valve locations, etc.

B. In all projects, contractor shall provide record drawings of all underground equipment and service runs. As-built drawings for underground work will include dimensions to actual locations finish grade elevations, and actual invert to underground structures equipment and service runs.

1.22 IDENTIFICATION AND NAMEPLATES

A. Provide engraved plastic labels screwed to all MECHANICAL equipment furnished under this contract including but not limited to: pumps, air handling units, rooftop units, exhaust fans, condensing units, control panels, starters, switches, panels, etc. Labels shall have black background, white letters; minimum letter height 3/8" high, self adhesive labels or punch tape type labels are not acceptable.

1.23 PENETRATIONS THRU FIRE RATED CONSTRUCTION

A. All penetrations by this contract through rated construction shall be sealed fire safe by a UL listed approved method.

B. All piping penetrations through walls, floors, etc. shall be sleeved.

C. All ductwork penetrations shall be furnished with trim frames.

D. All piping and ductwork penetrations through fire rated partitions, walls, floors, etc. shall be installed as follows; penetration shall be oversized 1/2" to 3/4" maximum. This contractor shall pack with fireproofing insulation, type FS cerablanket. Outside of penetrations (exposed surfaces around pipes and ductwork) shall be caulked and sealed with flame stop V, as manufactured by Flame Stop, Inc.; or an approved equal. Flame stop sealant shall be troweled smooth for finishing as required.

1.24 CONFINED SPACES

A. All work in pipe tunnels, mechanical pits, well manholes, etc. shall be performed by skilled tradesman and laborers with current certification for working in confined space. Contractor shall bear all costs to provide all safety equipment, ventilation, etc. as required by State and Federal Regulations and shall obtain all necessary permits for such work.

B. Contractor shall submit copy of current certifications and photo I.D. of all tradesman and laborers who will be working in confined spaces on this project.

1.25 COORDINATION

A. Layouts of duct and piping systems shown on contract drawings are diagrammatic. Actual duct and piping layouts shall be coordinated in the field by the contractor. Ductwork shop drawings shall be submitted for approval (see next section for coordination drawings if applicable). Coordinate with other trades and with existing conditions, as required for proper installation of all systems. Contractor shall verify that ductwork and piping layouts are coordinated with all other construction trades which might cause a conflict. Any changes due to systems not being properly coordinated shall be the contractor's responsibility.

B. All offsets, elbows, duct/pipe transitions, air vents, drains and accessories required to accommodate field changes found during coordination drawings are the responsibility of the contractor at NO additional cost.

C. NOTE: Ductwork and piping drawings will NOT be given to the contractor since it is expected of the contractor to field verify and draw the ductwork and piping.

D. Refer to section 013100 Project management and coordination for obtaining cad files from the architect.

E. All offsets, elbows, duct/pipe transitions, air vents, drains and accessories required to accommodate field changes found during shop drawings are the responsibility of the contractor at NO additional cost.

END OF SECTION

SECTION 230010 - CONCRETE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including the General and Supplementary conditions and Division 1 Specification Sections apply to the work of this Section.

1.02 SUBMITTALS

A. Concrete mix designs.
B. Reinforcing materials.
C. Shop drawings for reinforcing arrangements.
D. Concrete test reports.

1.03 QUALITY ASSURANCE

A. Comply with provisions of the following, specifications and standards, except where more stringent requirements are specified:

1. The American Concrete Institute (ACI) "Manual of Concrete Practice".
2. Applicable ASTM Standards.
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Concrete Practice".

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Metal forms shall be clean, free from rust and free from dents.

B. Form lumber shall be new when used for the first time on this job.

C. Plywood shall comply with United States Product Standard PS-1 for Plyform Class 1, Structural 1, Exterior Grade B-B or better.

D. Form coating compounds shall be of a commercial formulation that shall not bond with, stain or adversely affect the concrete surface. Confirm that any form coatings to be used are compatible with any concrete finish to be applied.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars (ReBar) - ASTM A615, Grade 60, deformed, shop fabricated.

B. Welded Wire Fabric (WWF) - ASTM A185, Welded steel wire fabric, in flat sheets only.

C. Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening Reinforcing Bars and Welded Wire Fabric in place. Use wire bar type supports complying with CRSI Class III recommendations.

D. For slab-on-grade use supports with sand plates or horizontal runners where chair legs will damage vapor barrier.

2.03 CONCRETE AND GROUT MATERIALS

A. Cement shall conform to ASTM C-150 Type I.

B. Normal weight concrete aggregates shall conform to ASTM C-33.

C. Concrete shall conform to ASTM C-94 for Ready Mix Concrete. Concrete shall have a minimum 28 day compressive strength of 3000 psi using a minimum of six sacks of cement per cubic yard. The slump for all concrete shall not exceed 4".

D. Time limit for concrete delivery truck shall be a maximum of 45 minutes.

E. Admixtures shall be compatible with all other materials to be used and shall meet the following:

1. Air-entraining agent shall conform to ASTM C260. Air entrainment shall be between 5% and 7% in all concrete exposed to freezing and thawing.

2. Chemical admixtures shall conform to ASTM C494 and must be specifically approved by Architect prior to their inclusion into any concrete. Calcium chloride shall not be used in any form.

F. Grout shall be non-shrink, non-metallic, high strength (5000 psi minimum at 28 days) cementitious material.

2.04 RELATED MATERIALS

A. Moisture retaining cover shall comply with ASTM C171, including waterproof paper, polyethylene film and coated burlap.

B. Absorptive cover shall be burlap cloth from jute or kenot, weighing approximately 9 oz. per sq. yard complying with AASHTO M182, Class 2.

C. Water resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and over-coated with black polyethylene on each side.

D. Vapor barrier consisting of seven-ply membrane with reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating and plastic anti-stick sheet. Water vapor transmission rate of 0.00 grains per sq. ft. per hour when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

E. Bonding agents shall be a 2 part, high modulus, moisture insensitive, polysulfide free, rigid epoxy containing 100% solids and shall conform to ASTM C-881, Type 2, Grade 2, Class B; ASTM C-883; ASTM D-638 and ASTM D-695.

F. Provide for installation of inserts, sleeves, fastening devices, dowels, etc. as required.

2.05 TESTING

A. Independent testing laboratory shall prepare cylinders, transport for lab cured specimens, perform all testing, and submit written test reports.

B. Sample fresh concrete (ASTM C172) at time of delivery.

C. Slump (ASTM C143) one test for each days pour for each class of concrete.

D. Air content (ASTM C231), pressure method for normal weight concrete, one test for each days pour or each time compression test cylinders taken.

E. Compression test specimens (ASTM C31), 4 standard cylinders. Stone and cure at testing laboratory. Prepare one set for each truck. Log locations of each test specimen.

F. Compressive strength testing (ASTM C39), first test at (7) days, second test at (14) days, third test at (28) days and fourth cylinder held in reserve for backup testing if required.

G. Test reports shall indicate name of testing company, cylinder identification, sample location, date of placement, concrete type, design strength, actual strength.

PART 3 - EXECUTION

3.01 CONCRETE PADS

A. All new concrete housekeeping pads shall be a minimum of 4” thick. Provide wire mesh in concrete pad. Provide bonding agent on floor and pin new concrete pad to existing concrete floor (minimum of four pins for a 48”x48” pad)

B. Provide concrete pads for all equipment in boiler room, whether indicated on drawings or not.

3.02 FORM WORK

A. Forms shall be constructed to conform to the required shapes, dimensions, line elevations and positions and shall be maintained sufficiently rigid and tight to prevent deformation under load and to eliminate cement leaks. Form surfaces shall be thoroughly cleaned for each use. Forms shall be oiled before reinforcing steel is placed.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Bevel wood inserts for forming key-ways, recesses, etc. for easy removal.

C. Coordinate form-work installation with other trades.

3.03 REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.

C. Place reinforcement to obtain at least minimum coverages of concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.04 CONCRETE PLACEMENT

A. Pre-Placement Inspection: Before placing concrete, inspect and complete framework installation, reinforcing steel and items to be embedded or cast-in. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. General: Comply with ACI 304, as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

C. Placing concrete in forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer in still plastic to avoid cold joints.

1. 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 recommended practices.

2. Do not use vibrators to transport concrete inside forms.

D. Placing concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position during concrete placement operations.

E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.

F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

3.05 SURFACE FINISHES

A. Rough Form Finish: For formed concrete surface "below grade" not exposed-to-view. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Trowel Finish: Apply trowel finish to interior equipment and housekeeping slab surfaces to be exposed-to-view. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as a trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Grind smooth any surface defects.

C. Non-Slip Broom Finish: Apply to exterior above or at grade slab surfaces. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to the short edge and finish slab perimeters with an edging tool.

D. Equipment Support Base Finish: Concrete surfaces of equipment support bases shall be finished per equipment manufacturer's recommendations.

E. Piers Finish: Top of piers shall be shaped to shed water and finish for support leg or equipment mount shall be per equipment manufacturer's recommendations.

3.06 CONCRETE CURING AND PROTECTION

A. Curing shall be accomplished by preventing loss of moisture, temperature change greater than 5°F in one hour to 50°F in any 24 hours, mechanical injury, or injury from rain or flowing water for a period of not less than 7 days. Curing compounds, if used shall be checked for compatibility with all finish coats.

B. Curing shall be started as soon as free water has disappeared from the concrete after placing and shall be accomplished by keeping the concrete surfaces damp. Where formed surfaces are cured in the forms, the forms shall be kept continually wet. If the forms are removed before the end of the curing period, curing shall be continued with moisture-cover curing method as described below.

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

3.07 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension and holes left by tie rods and belts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of the Engineer. Surface defects include: irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface. Flush out form tie holes, fill with dry pack mortar.

END OF SECTION

SECTION 230523 - PIPING SYSTEM VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to work in this section.

1.02 SUBMITTALS

A. Schedule of valves and service.
B. Product data for all valves.

1.03 REFERENCE STANDARDS AND CODES

A. All installations and materials shall conform to applicable 2020 New York State Building Code, and local building and plumbing codes.

B. All installations shall conform to requirements of Owner's Insurance carriers.

C. Refer to the latest edition and applicable sections of the following:

1. Underwriters Laboratories (UL)
2. American Society of Testing and Materials (ASTM)
3. American National Standards Institute (ANSI)
4. American Society of Mechanical Engineering (ASME)
5. Code for Pressure Piping B31.9 - Building Services Piping
6. American Welding Society (AWS)
7. National Fire Protection Association (NFPA)
8. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS)

1.04 GENERAL REQUIREMENTS

A. Ensure valves are dry and internally protected against rust and corrosion. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

B. Protect valve ends against damage to threads, flange faces and weld-end preps.

C. Do not use hand-wheels and stems as lifting or rigging points.

D. All valves and terminal water specialties shall be same size as upstream piping, unless otherwise indicated.

E. Furnish valves with pressure and temperature ratings as specified and required to suit system pressures and temperatures.

F. Furnish valves with either threaded, flanged or solder-joint end connections as specified.

G. Furnish chain wheel operators for valves 6" and larger when valve is to be mounted 8' or higher above finished floor elevations.

PART 2 - PRODUCTS

2.01 VALVE SCHEDULE

A. Note: Specialty valves specified in other sections.

	Pipe Fill	Pipe Size	Valve Type
1.	Heating Hot Water	Up to 2"	BV-1
2.	Heating Hot Water	2-1/2" & Over	WV-1
3.	Heating Hot Water	Up to 2"	CBV-1
4.	Heating Hot Water	2-1/2" & Over	CBV-2
5.	Heating Hot Water	Up to 2"	CKV-1
6.	Heating Hot Water	2-1/2" & Over	CKV-2

B. Valve Types

1. BV-1: Ball valve, size as required, sweat or threaded ends, forged bronze body, hard chrome plated ball, glass reinforced durafill seats, PTFE stem packing, 600 psi WOG non-shock, 150psi WSP for ¼”-2”, 450°F (@50psi) maximum temperature. Brass body is not acceptable and will be rejected. Series #B6000, B6001, Watts Regulator Co.; or equal.

2. CBV-1: Circuit balancing valve, size as required for nominal 3ft WG pressure drop. Note: the submitted pressure drop shall not exceed 2ft. The TAB contractor shall balance to 3ft. Y-pattern Style design and all metal parts of nonferrous, pressure die cast, nonporous Ametal copper alloy and high strength resin hand-wheel and sleeve. Provides a positive shut-off. Provision for connecting a portable differential pressure meter. Each meter connection shall have pressure/ temperature readout ports. Rubber O-ring disc to ensure positive shut-off. Valve shall provide multi-turn, 360° adjustment, digital handwheel with hidden memory feature to set the valve with precision tamper-proof setting. Model STAD, rated at 300 psig, 250°F, TA Hydronics; or equal.

3. CKV-1: Check valve, bronze body, bronze disc. rated at 200 psi, non-shock for 2" and smaller. Nibco Model #T-413; or equal.

4. FCV-1: **ADJUSTABLE** Automatic flow control valves. Valve gpm shall be factory set and shall automatically limit flow to within 5% of specified rate. For 3/4" to 2" valves flow cartridge shall be removable from valve housing without the use of special tools to provide access without breaking main piping. Cartridge flow rates shall be externally adjustable while system is in operation with 41 flow rate settings range per cartridge. A true design operating pressure (psid) range of 4.4 – 58 psi is required. Each valve should have 2 P/T ports. All automatic flow control valves shall be provided by single source with certified flow tests. Internal wear surfaces of the valve cartridge shall be stainless steel. The cartridge body shall have machined threads to compensate for the spring free height. Fixed shims are not acceptable. Cartridges shall be color coded to determine model type and GPM Range and a flow rate chart for external adjustment of flow rate settings shall be provided. For 3/4" to 2" valves, valve assembly shall consist of Y type body and O-ring union. 2-1/2" to 6" valves shall be flanged wafer style valves and shall be externally adjustable while system is in operation with 51 flow rate settings per valve insert. Static pressure rating of 580 psi with a temperature rating of 248 F. Valve shall be E-just, by FlowCon International.; B&G; or approved equal. **NOTE: It is the intent that an externally adjustable valve is used to simplify installation, so the balancer can set the flow and ensure that the correct flow is achieved.**

PART 3 - EXECUTION

3.01 GENERAL

A. Install all valves per manufacturers recommendations.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS:

A. Description of intended testing procedures.
B. Blank data forms indicating all intended test data points.
C. Written statement of coordination with sheetmetal contractor.
D. Written statement of coordination with piping contractor.
E. Written statement of acceptance of location and quantity of air and water balancing devices.
F. Pre-balance information from existing systems, where required.

1.03 QUALIFICATIONS

A. Acceptable Subcontractors are:

1. Member contractors of "Associated Air Balance Council".
2. Member contractors of "National Environmental Balancing Bureau".

B. Procedures and Methods: Follow written procedures published, one or more of following:

1. Associated Air Balance Council (AABC).
2. National Environmental Balancing Bureau (NEBB).

1.04 SCOPE OF WORK

A. Contractor shall perform testing, balancing and adjusting work on all new and existing equipment shown on plans, listed in this section and as required by applicable sections of the specification. Note: All existing equipment used in new or renovated systems is required to be tested adjusted and balanced.

B. Note: Air side systems shall be balanced prior to water balance.

C. Testing, adjusting and balancing is required for all of the following:

1. Air Side Equipment:
   a) Air Handling Units
   b) Supply, Return, Exhaust and Relief Duct Systems
   c) Terminal Equipment
   d) Diffusers, Registers and Grilles

2. Hydronic Equipment:
   a) Pumps
   b) Air Handling Unit Coils
   c) Terminal Equipment Coils
   d) Piping Distribution Systems
   e) Terminal Radiation Units

1.05 GENERAL REQUIREMENTS

A. It shall be responsibility of the Contractor to place all systems in satisfactory operating condition, including providing services of approved adjusting and balancing subcontractor regularly engaged in this type of work.

B. Furnish set of Bid Documents to subcontractor within ten (10) days after award of contract.

C. Adjusting and balancing shall be accomplished as soon as possible after systems are complete and before Owner takes possession.

D. All systems must conform with the following noise criteria:

1. Areas shall have NC30 to 35.

E. Initial adjustment and balancing to quantities indicated on design drawings and thereafter as required to satisfy job conditions to satisfaction of the Architects.

F. Adjusting and balancing shall be accomplished under appropriate outdoor temperature conditions.

G. Immediately prior to subcontractor's arrival on project:

1. Adjust all balancing cocks and dampers open.
2. Place all equipment in operating condition.
3. Clean all strainers.
4. Remove all temporary air filters and install design filters.

H. During course of the adjusting and balancing work:

I. Maintain qualified personnel at project at all times for system operation, trouble shooting, assistance, etc.

J. Change pulleys and belts as required to meet system performance requirements. Adjustable sheaves shall not be operated at extreme end of adjustment. Replace adjustable sheaves with proper size to operate approximately in mid-range.

K. Perform necessary mechanical adjustments in conjunction with balancing procedure.

L. Replace all flow balancers in new and existing systems that cannot be manipulated to satisfy balancing requirements.

1.06 JOB VISIT

A. Balancing subcontractor shall visit job prior to concealment of work and advise location of dampers, test connections, etc.; advise Architects by letter.

B. Make any changes or additions of types, locations, etc. of balancing facilities.

1.07 FINAL REPORT

A. Upon completion, all information shall be inserted in report form listing all items required by specifications. Entire report shall be typewritten and shall be submitted to Architect and Engineer for approval. Results shall be guaranteed. Provide (3) hard copies and electronically submit to architect.

B. Complete balancing analysis on all individual equipment and systems as specified shall be included in report.

C. Contractor shall be subject to recall to site to verify report information before approval of report by Architects.

D. Record action taken to adjust all systems to meet design specifications.

E. Report on condition of installations (i.e. - complete/inoperative etc.)

F. Final reports which do not contain all data required by this section will be rejected. Contractor will be required to retest and resubmit for all applicable systems with missing information.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide all tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, Pitot tubes, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers, tachometers, etc. required to execute the work. Instruments used shall be accurately calibrated.

1. NOTE: IF VFD IS PROVIDED, CONTRACTOR SHALL USE VFD FOR BALANCING OF AIR OR HYDRONIC EQUIPMENT. SYSTEM TO BE BALANCED WITH TDV COMPLETELY OPEN.

PART 3 - EXECUTION

3.01 AIR AND HYDRONIC SYSTEMS

A. Preparation:

1. Examine bid documents and notify Architects of any questions regarding balancing, within 30 days after receipt of bid.

2. The balancing subcontractor shall review sheetmetal shop drawings and mark the location of all required balancing dampers before duct fabrication.

3. Written notice of coordination between Contractor and balancing contractor to be submitted to Architect and Engineer.

B. Requirements for Air-Side Testing, Adjusting & Balancing:

1. Air Handling Equipment:
   a) Record all drive information (i.e. - sheave type, belt size, motor data).

   b) Test and adjust fan rpm to design requirements.

   c) Record RPM and final sheave position.

   d) Test and record motor no load, and full load amperes, and determine operating brake horsepower.

   e) Test and record inlet and discharge static pressures.

   f) Test, adjust and record SA, RA, OA and relief air flows for design recirculated air cfm.

   g) Test, adjust and record SA, RA, OA and relief air flows for full design outside air cfm. Make special effort to test and record total relief cfm air.

h) Test and record entering and leaving air temperatures. (D.B. heating and cooling)

i) Test and record equipment sound levels in closest occupied space.

2. Ductwork & Air Distribution Systems:
   a) Adjust all main supply, exhaust and return air ducts to proper design cfm, supply, exhaust, return and relief.

   b) Test and adjust each diffuser, grille, and register to within 10% of design requirements.

   c) After grilles, diffusers and registers are set at final CFM, check and record sound levels at occupant level at all locations.

   d) Each grille, diffuser, and register shall be identified as to location and area.

   e) Size, type and manufacturer of diffusers, grilles and registers, and all tested equipment shall be identified and listed; manufacturer's ratings on all equipment shall be used to make required calculations.

   f) Readings and tests of diffusers, grilles and registers shall include required fpm velocity and test resultant velocity, required cfm and test resultant cfm after adjustments.

3. Terminal Units:
   a) Adjust terminal units to cfm.

4. Fans (Supply & Exhaust):
   a) Record all drive information (i.e. - sheave type, belts, size, motor data).

   b) Test and adjust fan rpm to design requirements.

   c) Record cfm, rpm and final sheave position.

   d) Test and record motor no load and full load amperes and determine operating brake horsepower.

   e) Test and record inlet and discharge static pressures.

   f) In cooperation with control manufacturer's representative, make mechanical adjustments of automatically operated dampers to operate as specified, indicated, and/or noted; subcontractor shall check these damper control operations for proper calibrations and list those requiring adjustment by control installers.

   g) All diffusers, grilles and registers shall have air patterns adjusted to minimize drafts in all areas.

   h) A record of all final settings shall be made, preferably at each piece of equipment by an appropriate approved mark or if necessary by description on the report schedule.

   i) Record all space temperatures. If space temperatures vary more than 2°F from thermostat setting readjust air flows to obtain proper temperature.

C. Requirements for Water Systems Testing, Adjusting & Balancing:

1. Initial Procedure:
   a) Examine bid documents and notify Architects of any questions regarding balancing, within 30 days after receipt of bids.

   b) Air systems shall be examined first.

   c) Open all manual valves to full open position; close coil bypass stop valves; set automatic control valves to full coil flow.

   d) Examine water in system and determine if water has been treated and cleaned.

   e) Check expansion tank and/or compression tanks to determine if they are not air bound or water logged and system is full of water and a proper minimum fill pressure.

   f) Check all air vents at high points of water systems and determine if they are installed and operating freely.

   g) Balance terminal units furthest from pumps, work towards pumps. Final balance pump flow control valve(s) last.

2. Piping Distribution System:
   a) Test and adjust all flow control devices.

   b) Record final settings and distribution gpm.

   c) Test and record pressure on non adjustable flow control valves. Verify pressure is within control range on valve.

3. Hydronic Coils (HW):
   a) Set all temperature controls so all coils are calling for full flow.

   b) After adjustments to coils are made, recheck settings at pumps and readjust as required.

   c) Read pressure and differential across coils and set flow rate on coil for full heating; set pressure drop across bypass valve to match coil full flow pressure drop.

   d) Record and check the following items at each heating element:
      (1) Inlet water temperature.
      (2) Leaving water temperatures.
      (3) Pressure drop.

   e) Check water temperatures at outlet side of heating coils; Note: drop of temperature from source.

   f) Upon completion of flow reading and adjustment of coils, mark all settings and record data. Show on schematic sketch form wherever practical.

END OF SECTION

SECTION 230713 - DUCTWORK INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 WORK INCLUDED

A. Insulate all ducts and as required by contract documents.

1.03 REFERENCES

A. Test standards and reports for evaluating and rating performance of fire rated shaft enclosures and zero inch clearance ratings for duct wrap systems for compliance to Code.

1. ISO 6944-1985, ‘Fire Resistive Tests - Ventilation Ducts’.

2. ASTM E 2336, ‘Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems’.

3. ASTM E 814 (UL1479), ‘Fire Tests of Through-Penetration Fire Stops Standard’.

4. ASTM E 84, ‘Standard Test Method for Surface Burning Characteristics of Building Materials’.

5. ASTM C 1338, ‘Fungi Resistance of Insulation Materials and Facings Standard’.

6. NFPA 96 ‘Standard for Ventilation Control & Fire Protection of Commercial Cooking Operations’.

1.04 SUBMITTALS

A. Manufacturer data for all materials used in contract. Submit schedule of insulation applications.

PART 2 - PRODUCTS

2.01 DUCTWORK INSULATION

A. NOTE: IF A CONDITION IS NOT LISTED BELOW, IT SHALL BE INSULATED WITH 2" RB.

B. All exhaust fan and relief hoods shall have the void between the duct and the curb completely insulated with FB insulation.

C. All relief/intake hoods, goosenecks, louvered penthouses and any other ductwork that has exterior termination that have exposed surfaces inside the building shall be insulated as outside air ductwork.

D. The following is a schedule for ductwork insulation:

	Duct System & Location	Type	Thickness	Notes
1.	Outside Air, Relief Air, and Exhaust Air Ducts & Plenum Exposed to Air at Outside Ambient Temperatures (For All Air Handling and Energy Recovery Units), Energy Recovery Exhaust:			
	a) Concealed Spaces	FB	3"	(2)
	b) Exposed Spaces	RB	2"	(1)
2.	Supply & Return Duct:			
	a) Concealed Spaces	FB	2.2"	(2)(4)
	b) Exposed Spaces	RB	2"	(1)(4)
3.	Return Duct within a plenum ceiling	NONE		(6)
4.	Exhaust Fan Ductwork	FB	3"	(2)(5)
	a) Between the backdraft or mechanical damper and the space (ductwork having room conditioned ductwork), no insulation is required. All other exhaust ductwork (or if there is no damper present) shall be insulated as outside air ductwork.			
	b) This does not apply to energy recovery units, refer to above for all energy recovery units.			
5.	Crawlspace	FB	2.2"	(2)(3)
6.	Duct Coils (coil & duct 3'-0" min. upstream & downstream, including the coil)	FB	2.2"	(2)

Schedule Notes [some notes might not be used]:

(1) Weld pins with tapered joints.
(2) Stapled edge with mechanical fasteners on ducts over 24" wide.
(3) Provide insulation whether duct is lined or not
(4) Ducts with internal liner do not require additional insulation unless otherwise noted. This does not apply to special 14 gauge supply duct.
(5) Exhaust duct exposed to air at ambient temperature must meet the requirements listed above.
(6) Exterior insulation is not required on return ductwork contained within areas with a ceiling acting as a plenum return – provide exterior insulation per schedule on return ductwork when outside of areas of plenum return.

E. Duct insulating materials shall be as follows:

1. FB: Flexible fiberglass blanket type duct wrap with factory applied foil faced jacketing reinforced with fiberglass scrim laminated to UL rated kraft. Minimum thickness = 2.2in. Insulation shall be 1-lb/ft3 with a thermal conductivity (k-value) of 0.27 Btu x in/(hr x ft^2 x °F) at 75°F mean temperature when compressed. Provide with 2" stapling tab. Provide Type #75, Johns Manville; or equal.

2. RB: Factory fabricated rigid fiberglass board with factory applied white kraft facing bonded to aluminum foil, reinforced with fiberglass yarn. Minimum thickness = 2in. Temperature limit 450°F unfaced side, 3.0 lb./cu. ft. density. Thermal conductivity (k-value) of 0.23 Btu x in/(hr x ft^2 x °F) at 75°F mean temperature. Insulation to have a R value of 4.3 per inch. Type #814, Johns Manville; or equal.

3. ERB: Furnish and install 3" thick, closed-cell polyisocyanurate foam core board with foil facing on all ductwork segments and fittings installed outside of the building. Board shall have a R-value of 19 (for a 3” thick sheet). Board shall act as a vapor barrier with a vapor permeance of 0.05 perms. Provide Johns Manville AP Foil Faced; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF DUCTWORK INSULATION

A. All insulation, jacketing and accessories are to be installed in strict accordance with manufacturer's instructions.

B. Flexible Blanket Insulation (FB): Insulation shall be tightly wrapped around ductwork with all circumferential joints butted and longitudinal joints overlapped minimum of 2".

1. Adhere insulation to metal with 4" wide strips of insulation bonding adhesive at 8" on center and, on ductwork over 24" wide, additionally secure insulation to bottom with pins welded to duct 18" on center. On circumferential joints, secure 2" flange of facing using 9/16" flare door staples applied 6" on center and tape with 3" wide foil reinforced kraft tape. On longitudinal joints, secure overlap in the same manner. All pin penetrations or punctures in facing shall be similarly taped. If single blanket or sufficient thickness is not available, install two layers of equal thickness with vapor barrier facing on outer layer only.

C. Rigid Board Insulation (RB): Impale insulation over pins welded to duct on 21" centers, cut to extend 1/8" beyond face of board and cover with vapor seal mastic and self-locking cap. Seal all edges and butt joints with 5" wide strips of self-sealing pressure sensitive tape matching surface and finish of duct insulation.

END OF SECTION

SECTION 230719 - PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 SUBMITTALS

A. Schedule of all materials used.

B. Product data for all materials.

1.03 WORK INCLUDED

A. Insulate all pipes as required by contract documents.

PART 2 - PRODUCTS

2.01 PIPING INSULATION

A. NOTE: IF A CONDITION IS NOT LISTED BELOW, IT SHALL BE INSULATED WITH 1-1/2" TYPE A OR TYPE B, DEPENDING ON THE PIPE.

B. The following is a schedule for pipe insulation:

		Pipe Diameter Up To 1-1/4" Min. Insulation Thickness	Pipe Diameter 1-1/2" & Larger Min. Insulation Thickness	Insulation Type	Notes
1.	Heating Hot Water	1-1/2"	2"	A	(1)(2)(3)(5)(6)
2.	Condensate Drain	1/2"	1/2"	B	(4)
3.	Refrigerant Suction, Liquid Piping and Hot Gas Bypass				
	a) INTERIOR	1/2"	1/2"	B	(4)(7)
	b) EXTERIOR	1"	1"	B	(4)(5)

Schedule Notes:

(1) Pre-Molded PVC Fitting Covers: Zeston, Inc.; or equal.

(2) Self-seal lap.

(3) Staples-outward clinching.

(4) Foamed plastic pipe insulation adhesive; Armstrong Co.; 520 adhesive; or equal as required to ensure there are no gaps in insulation.

(5) Exterior insulation shall be covered with exterior jacketing (venture clad) as specified hereinafter. All piping shall be supported to prevent sagging of the pipe, provide supports as required.

(6) Furnish high impact strength PVC piping jacketing, as specified hereinafter, for all exposed piping in all finished spaces.

(7) Provide manufacturers pre-insulated line sets with flare connections where possible. Provide rubber insert cushy clamps for all unistrut piping risers and hydra-zorb insulation unistrut cradles for horizontal piping. Ensure all piping is insulated with no gaps.

C. Equipment Insulation:

1. All hot water and chilled water fittings, valves, water specialties, flanges, air separators and pumps shall be insulated per this section, NO EXCEPTIONS!

2. Note: Do not run any insulation through pitch pockets.

3. Note: All insulation requirements of this section shall apply to flexible expansion joints (EXP-1).

2.02 MATERIALS FOR PIPING INSULATION

A. Pipe insulating materials shall be as follows:

1. Type A: Fiberglass pipe insulation jacketed with a reinforced vapor retarder jacket and factory applied longitudinal acrylic adhesive closure system. Insulation shall have a maximum service temperature of 850°F with a thermal conductivity (k-value) of 0.23 Btu x in/(hr x ft^2 x °F) at 75°F mean temperature per ASTM C518 and UL rated for maximum flamespread of 25 and smoke developed of 50. Johns Manville. Micro-Lok; or equal.

2. Type B: Closed Cell Foam Pipe Insulation. Insulation shall have a maximum service temperature of 300°F with a thermal conductivity (k-value) of 0.28 Btu x in/(hr x ft^2 x °F) at 75°F mean temperature per ASTM C518 and UL rated for a maximum flamespread of 25 and smoke developed of 50.
   a) Pre-slit foamed plastic pipe insulation with slit positioned at side and vapor sealed with adhesive on all joints. AP Armaflex Tube Insulation; or equal.

B. High Impact Strength Jacketing: Furnish PVC jacketing and fitting covers, conforming to ASTM E-84; flame spread 25, smoke developed 50, white high gloss finish, 0.02" minimum thickness.

C. Furnish pre-molded PVC jacketing and fitting covers, lo-smoke type, as manufactured by Proto Corp.; or an approved equal.

D. Exterior Jacketing: Material shall be Venture Clad 1579GCW-E as manufactured by Venture Tape; or approved equal. To be applied over all exterior piping, and as noted elsewhere.

1. Jacketing material shall have a 24.0 mils thickness, 13-ply embossed aluminum made with (2) layers of aluminum foil, a layer of polyester film, an outer layer of tedlan film and an acrylic pressure sensitive adhesive layer.

2. Jacketing material to provide a 10 year membrane warranty, to be UV resistant and have zero permeability.

PART 3 - EXECUTION

3.01 PIPING INSULATION INSTALLATION

A. Type of Insulation Listed and Methods of Installation:

1. Fiberglass Pipe Insulation (A): Butt joints sealed with 3" wide strips of jacket material with factory applied pressure sensitive adhesive, laps and strips applied over clean dry surfaces and all longitudinal and circumferential seams rubbed hard with blunt steel edge. Cover valves, fittings, flanges, etc. with pre-formed fiberglass fittings and premolded PVC plastic jackets.

2. Closed Cell Foam Pipe Insulation (B): Insulate fittings, valves and flanges with mitered and fitted sections of foamed plastic pipe insulation positioned and fastened by adhesive on all joints.

B. Special Requirements:

1. Heating piping hangers shall be applied directly to piping. Cut-out insulation for hanger and cover with jacketing. Insulation shall be "butt-up" to hanger as tightly as possible.

2. Cooling/refrigeration piping insulation shall be continuous and have no breaks, insulation shield shall be applied between insulation and hanger.

END OF SECTION

SECTION 230993 – TEMPERATURE CONTROLS

PART 1 – GENERAL

1.01 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. Consult the above for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 0 and Division 1.

1.02 CONNECTION TO EXISTING CONTROL SYSTEM

A. All new control equipment must integrate seamlessly with existing **Automated Control Logic** (ACL) Schneider Electric DDC system. All new digital controllers are required to communicate fully with the existing temperature control network.

B. All new controllers provided under this project must be connected to the existing BAS System. Extend network (including software) as required to provide a fully integrated control system.

C. BAS System Contractor shall modify programming in host computer to accept all new equipment and I/O points.

D. Contractor must visit site to inspect existing equipment required for operation of new systems. If existing miscellaneous equipment is not of sufficient size or is not functioning properly, contractor must include replacement or refurbishment in his bid.

1.03 ACCEPTABLE MANUFACTURERS

A. Maufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Automated Control Logic

Note: ACL is the districts preferred contractor.

B. If the Contractor is proposing to provide a product by a Manufacturer other than those listed above, the Contractor must, at least 10 days prior to bid opening, to obtain the approval of the Owner for the equal manufacturer, along with provided 5 references of sites where the company has performed projects to similar type and the same controls as what is onsite currently.

1.04 SOFTWARE UPGRADES / SERVER UPGRADES

A. At the completion of the project, the contractor shall ensure that all software is at its latest available revision and that all hardware (servers, workstations, laptops, etc.) shall be capable of meeting all requirements to ensure that the (OWNER) has been furnished with a completely updated system.

B. If replacement of existing hardware is required due to compatibility with the latest revision of software, it shall be the responsibility of this contractor to provide new hardware.

1.05 CONTROL SYSTEM DESCRIPTION

A. Provide labor, controls materials, controls equipment and services as required for a complete BACnet Building Automation System (BAS), to perform the functions described in this Section. Controls System shall be Web-based and accessible either directly connected and/or through the owners IP LAN network.

B. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system.

C. The BAS shall meet BACnet communication standards to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects. These open protocol communication standards are discussed in more detail later in this specification.

D. BAS controllers shall be listed by BACnet Testing Laboratories (BTL) with appropriate classification.

E. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and equipment on this project.

F. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

G. The BAS manufacturer shall provide all hardware and software necessary to implement the functions and sequence of operations specified.

1.06 SUBMITTAL REQUIREMENTS

A. BAS manufacturer shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer has reviewed submittals for conformity with the plan and specifications. Five (5) copies are required. All shop drawings shall be provided to the Owner electronically once they have been approved and as-built drawings have been completed.

B. Quantities of items submitted shall be reviewed by the Engineer. Such review shall not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.

C. Provide the Engineer with any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.

D. Submit the following within 45 days of contract award:

1. A complete bill of materials of equipment to be used indicating quantities, manufacturers and model numbers.

2. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.

3. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.

4. Note: schedule of valves and dampers shall be submitted independently of other submittals; do not combine with other submittals.

5. Provide all manufacturers' technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include:
   a) Building Controllers
   b) Custom Application Controllers
   c) Application Specific Controllers
   d) Operator Workstations
   e) Portable Operator Terminals
   f) Auxiliary Control Devices

6. Room schedule including a separate line for each VAV box and/or terminal unit indicating location and address.

7. Samples of graphic display screen types and associated menus.

8. Provide proposed Building Automation System architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements.

9. Provide detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.

10. Provide points list showing all system objects and the proposed object names.

11. Provide a sequence of operation for each controlled mechanical system and terminal end devices.

12. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

E. Project Record Documents: Upon completion of installation, submit PDF of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic drawing files shall be provided.

2. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.

3. Operating and Maintenance (O & M) Manuals - These shall be as-built versions of the submittal product data. In addition to the information required for the submittals, Operating & Maintenance manual shall include:
   a) Names, address and 24-hour/7-day per week telephone numbers of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.

b) Procedures for operating the BAS including logging on/off, alarm management, generation of reports, trends, overrides of computer control, modification of setpoints, and other interactive system requirements.

c) Description of the programming language including syntax, statement descriptions, algorithms, calculations, point database creation and modification, program creation and modification, and operator use of the editor.

d) Explanation of how to design and install new points, new DDC controllers, and other BAS hardware.

e) Preventative Maintenance and calibration procedures; hardware troubleshooting; and hardware repair and/or replacement procedures.

f) Documentation of all software program logic created for Custom Programmable Controllers including the overall point database. Provide one set of magnetic media containing files of the software and point database.

g) One set of electronic media containing files of all operator color graphic screens for the project.

h) A list of recommended spare parts including pricing, manufacturer, supplier, and part numbers.

i) Documentation, installation, and maintenance information for all third party hardware/software products provided including personal computers, printers, hubs, sensors, valves, etc.

j) Original issue media for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

k) Licenses, Guarantee, and Warranty documents for all equipment and systems.

1.07 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 232113 – Hydronic Piping

1. Control Valves
2. Temperature Sensor Wells and Sockets
3. Hydronic Pressure Taps
4. Hydronic Flow Meters

B. Section 233300 – Ductwork Accessories

1. Automatic Dampers
2. Airflow Stations

1.08 DEFINITIONS

Term	Definition
UCP	Unitary Controller
ACP	Air Handler Controller
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Control Systems Server	A computer(s) that maintain(s) the systems configuration and programming database.
Controller	Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols.
Local Area Network	Computer or control system communications network limited to local building or campus.
Master-Slave/Token Passing (MS/TP)	Data link protocol as defined by the BACnet standard.
Point-to-Point	Serial communication as defined in the BACnet standard.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
Protocol Implementation Conformance Statement (PICS)	A written document that identifies the particular options specified by BACnet that are implemented in a device.
Router	A device that connects two or more networks at the network layer.
Wiring	Raceway, fittings, wire, boxes and related items.

1.09 CODES AND STANDARDS

A. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.

1. Underwriters Laboratories: Products shall be UL-916-Energy Management Systems for BAS components & ancillary equipment

2. Underwriters Laboratories: Products shall be UL-873 Temperature Indication & Regulating Equipment.

3. Federal Communications Commission –Part 15- Subpart J.

4. All products shall be labeled with the appropriate approval markings. System installation shall comply with NFPA, NEMA, Local and National Standards.

5. ASHRAE/ANSI 135-2012 (BACnet) - (System Level Devices) - Building Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

6. ASHRAE/ANSI 135-2012 (BACnet) - (Unit Level Devices) - Unit Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

1.10 QUALITY ASSURANCE

A. BAS Manufacturer Qualifications

1. The BAS manufacturer shall have an established business office within 100 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.

2. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.

3. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

1.11 SYSTEM PERFORMANCE

A. Performance Standards. The BAS system shall conform to the following:

1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator's request.

2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.

3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.

4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.

5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

9. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.
   a) Table 1: Reporting Accuracy *(applicable to the project)*

Measured Variable	**Reported Accuracy**
Space Temperature	±1°F
Ducted Air	±2°F
Outside Air	±2°F
Water Temperature	±1°F
Delta –T	±0.25°F
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Air Flow (terminal)	±10% of reading
Air Flow (measuring stations)	±5% of reading
Air Pressure (ducts)	±0.1 "W.G.
Air Pressure (space)	±0.01 "W.G.
Water Pressure	±2% of full scale *Note 1
Electrical Power	5% of reading *Note 2
Carbon Monoxide (CO)	± 50 PPM
Carbon Dioxide (CO2)	± 50 PPM

Note 1: for both absolute and differential pressure
Note 2: * not including utility supplied meters

1.12 WARRANTY REQUIREMENTS

A. Warranty all work as follows:

1. BAS system labor and materials shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. BAS failures during the warranty period shall be adjusted, repaired, or replaced at no charge to the Owner. The BAS manufacturer shall respond to the Owner's request for warranty service within 24 hours of the initiated call and will occur during normal business hours.

2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the BAS is operational, and has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of the warranty period.

3. Operator workstation software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during the warranty period. Written authorization by the Owner must be granted prior to the installation of these updates.

4. The BAS manufacturer shall provide a web-accessible Users Network for the proposed System and give the Owner free access to question/answer forum, user tips, upgrades, and training schedules for a one year period of time correlating with the warranty period.

1.13 SYSTEM MAINTENANCE

A. Perform Building Automation System preventative maintenance and support for a period of 1 year (beginning the date of substantial completion).

1. Make a minimum of 2 complete Building Automation System inspections, in addition to normal warranty requirements. Inspections to include:
   a) System Review – Review the BAS to correct programming errors, failed points, points in alarm, and points that have been overridden manually.
   b) Seasonal Control Loop Tuning – Control loops are reviewed to reflect changing seasonal conditions and/or facility heating and cooling loads.
   c) Sequence of operation verification – Systems all verified to be operating as designed and in automatic operation. Scheduling and setpoints are reviewed and modified.
   d) Database back-up
   e) Operator coaching

2. Technician shall review critical alarm log and advise owner of additional services that may be required.

3. Technician shall provide a written report to owner after each inspection.

B. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

1.14 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project specific software and documentation shall become the owner's property upon project completion.

1.15 SEQUENCE OF OPERATION

A. Unit Shut Down

1. All units connected to FACP shall be shut down in the event of fire. (By EC via fire alarm system).

2. All units with low limit controllers (freezestats) shall be shut down if supply air temperature drops below 35°F. Shut down includes closing OA dampers, shut down fan, open control valve (or face damper).

3. All low limit controls shall be hard wired to break fan controls. Wiring low limit through DDC is not permitted to break fan controls. Wiring from LC-1 to DDC system is for alarm purposes only.

4. When low limit control is activated, send auxiliary alarm signal to DDC unit controller. DDC system shall annunciate alarm condition.

5. **All temperature control valves and dampers will be spring return and shall fail to the "Safe" position for that system.**

6. **Bypass valve application will be size for 50% of the pump capacity of that system.**

B. Remote Monitoring:

1. Provide all software necessary to monitor all sensors, equipment status and alarm conditions at operate workstation and local second tier controllers.

2. Provide all software necessary to recognize, process and record alarm conditions as required by Owner.

C. Occupied/Unoccupied Cycle:

1. Each system with DDC controls shall function as an individual D/N zone with individual event times for start/stop.

2. Stagger initial start times to prevent simultaneous occupied cycle activation for all equipment.

3. In unoccupied cycle, when room sensor override button is pushed, start software timer (setpoint 2 hours) to provide Day (occupied) cycle for a software selectable period of time after which system reverts to Night (unoccupied) cycle.

4. While software timer is operating ignore additional override switch signals. System shall ignore switch signals initiated when area is in occupied cycle.

D. Morning Warm-Up: Provide software routine to initiate morning warm-up when outdoor conditions dictate, warm-up schedule shall be adaptive (i.e. optimize energy usage). During morning warm-up for classrooms and shop areas with motion detector, the detector is overridden until room occupied temperature setpoint is reached, duration (2) hours (adjustable).

E. Refer to drawings for unit specific sequences.

PART 2 – PRODUCTS

2.01 GENERAL DESCRIPTION

A. The Building Automation System (BAS) shall use us an open BACnet architecture and DDC controllers that are certified by BACnet Testing Laboratories (BTL) with the appropriate classifications. The BAS shall be capable to integrae to third-party devices and applications. The system shall be for use on the the Internet, or intranets using off the shelf, industry standard technology compatible with the owner provided network.

B. The Building Automation System (BAS) shall consist of the following:

1. BACnet Testing Laboratories Certified Controllers
2. Portable Operator Terminal(s)
3. Networking processing, data storage, and communications equipment
4. Other controls components required for a complete and working BAS

C. The Building Automation System (BAS) shall be modular in nature, and shall permit expansion of both capacity and functionality through addition of sensors, controllers, actuators, and operator devices, whilre reusing existing controls equipment.

2.02 BAS ARCHITECTURE

A. Communication Network

1. This project shall be comprised of a high speed Ethernet network utilizing BACnet/IP communications between System Controllers and Workstations. Each System Controller shall function as a BACnet Router to each unit controller providing a unique BACnet Device ID for all controllers within the system. Communications between System Controllers and sub-networks of Custom Application Controllers and/or Application Specific Controllers shall be as defined below.

2. Each System Controller shall perform communications to a network of Custom Application and Application Specific Controllers using BACnet/Zigbee (802.15.4) as defined by the Zigbee Standard.
    a) Each communication interface shall be Zigbee Building Automation Certified product as defined by the BACnet Standard and the Zigbee Alliance.
    b) Each System Controller shall function as a BACnet Router to each unit controller providing a unique BACnet Device ID for all controllers within the system.
    c) Wireless equipment controllers and auxiliary control devices shall conform to:
        (1) IEEE 802.15.4 radios to minimize risk of interference and maximize battery life, reliability, and range.
        (2) Communication between equipment controllers shall conform to ZigBee Building Automation (ZBA) standard as BACnet tunneling devices to ensure future integration of other ZBA certified devices.
        (3) Operating range shall be a minimum of 200 feet (60 m); open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.
        (4) To maintain robust communication, mesh networking and two-way communications shall be used to optimize the wireless network health.
        (5) Wireless communication shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications.
        (6) Certifications shall include FCC CFR47 - RADIO FREQUENCY DEVICES - Section 15.247 & Subpart E.

3. Each System Controller shall perform communications to a network of Custom Application and Application Specific Controllers using BACnet/MSTP (RS485) as defined by the BACnet standard.

B. Integrator Panel:

1. The BAS System shall include appropriate hardware equipment and software to allow bi-directional data communications between the BAS and the 3rd Party manufacturers' control panels. The BAS shall receive, react to, and return information from multiple building systems, including equipment manufacturers' integral packaged controls that do not have the BACnet protocol.

2. All data required by the application shall be mapped into the BAS database, and shall be transparent to the operator.

3. Point inputs and outputs from from the third-party controllers shall have real-time interoperability with the BAS such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, and Local Area Network Communications.

BACNET Protocol Integration:

4. The neutral protocol used between systems will be BACnet and must comply with the ASHRAE BACent standard 135.

5. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.

6. The ability to command, share point object data, chance of state data, and schedules between the host and BACnet systems shall be provided.

C. The Controls Contractor shall provide all communication media, connectors, repeaters and network switches routers necessary for the high speed Ethernet communications network.

2.03 OPERATOR USER INTERFACE

A. Furnish 1 PC based operator interface as shown on the system drawings. Each operator web interface shall be able to access all information in the system. Operator interfaces shall reside on the same dedicated high-speed IP network as the System Controller(s).

1. Each operator interface PC shall include the following:
   a) Hardware type
      (1) PC or Laptop
   b. Minimum Hardware
      (1) Pentium Core 2 DUO or better
      (2) 4 GB RAM
      (3) 100 GB hard drive space
   c. Internet Browser compatibility outlined in the following sections.

B. Operator web interface

1. The operator web interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).

2. The operator web interface shall support the following Internet web browsers:
   a) Internet Explorer 11.0+
   b) Firefox 47.0+
   c) Chrome 51.0+

3. System Security
   a) Each operator shall be required to login to the system with a user name and password in order to view, edit, add, or delete data.

   b) User Profiles shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator.

   c) Each operator shall be allowed to change their user password.

   d) The System Administrator shall be able to manage the security for all other users.

   e) The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.

   f) User logon/logoff attempts shall be recorded.

   g) The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

   h) All system security data shall be stored in an encrypted format.

   i) The system shall support Active Directory for user set-up and management.

   j) The system shall track and record all user log-in activity and all changes done at the enterprise level including who made the change, when, what was changed, pervious value and new value.

4. Database
   a) Database Save: A system operator with the proper password clearance shall be able to archive controller back-ups on the designated Enterprise operator web interface PC.

   b) Database Restore: The system operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.

   c) Database Limits. The system operator shall have the ability to set limits on Alarm Log, Global Point Control Log, System Log, and User Change Log to manage database size.

5. On-line Help and Training
   a) Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.

   b) On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

6. System Diagnostics
   a) The system shall automatically monitor the operation of all network connections, building management panels, and controllers

   b) The failure of any device shall be annunciated to the operators.

7. Customizable Navigation Tree
   a) The Enterprise operator web interface shall include a fully customizable navigation tree that shall allow an operator to do the following:
      (1) Move and edit any of the nodes of the tree.
      (2) Move entire groups to any area of the tree
      (3) Change the name of any node in the tree
      (4) Create custom nodes for any page in the web interface including graphics, data log views, schedules, and dashboards.
      (5) Support navigation from multi-building to single building view.
      (6) Provide the ability to assign graphics to any node in the tree.
      (7) Ability to create folders and assign and change hierarchy of nodes of the tree.

8. Equipment & Application Pages
   a) The Enterprise operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
      (1) Animated Equipment Graphics for each major piece of equipment and floor plan in the System.
      (2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
      (3) Historical Data (As defined in Data Log section below) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
      (4) View of all custom graphical programming for supported controllers in real time.
      (5) View and management of all points for equipment and applications.
      (6) Support documents that have been assigned for that equipment.
      (7) Live data view for any selected points.
      (8) Touch friendly design for all action buttons, navigation, and spacing.

9. System Graphics. Enterprise operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.
    a) Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point and-click navigation between zones or equipment, and to edit set points and other specified parameters.

    b) Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.

    c) Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.

    d) Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

    e) Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

10. Custom Graphics
    a) The operator interface shall be capable of displaying custom graphics in order to convey the status of the facility to its operators.

    b) Graphical Navigation. The Enterprise operator web interface shall provide dynamic color graphics of building areas, systems and equipment.

    c) Graphical Data Visualization. The Enterprise operator web interface shall support dynamic points including analog and binary values, dynamic text, static text, and animation files.

    d) Custom background images. Custom background images shall be created with the use of commonly available graphics packages such as Adobe Photoshop. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as GIF and JPEG.

11. Graphics Library. Furnish a library of standard MECHANICAL equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.

12. Document Support. The Enterprise operator web interface shall support the ability to import support files into a support files library.
    a) Imported support files can include the following types of document formats: pdf, docx, xlsx, pptx, jpeg, tif, bmp, png, jpg, gif.

    b) All imported support files can be associated directly with equipment or family types that can then be accessed directly from standard pages.

13. Manual Control and Override
    a) Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
    b) Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
    c) Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
    d) Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
    e) Global Point Control. Provide a method for a user to view, override, and edit if applicable, the status of multiple object and properties in the system. The point status shall be available by menu, on graphics or through custom programs.

14. Engineering Units
    a) Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system.

    b) Unit selection shall be able to be customized by locality to select the desired units for each measurement.

15. Scheduling. A user shall be able to perform the following tasks utilizing the Enterprise operator web interface:
    a) Create a new schedule, defining the default values, events and membership.
    b) Create expectations to a schedule for any given day.
    c) Apply an exception that spans a single day or multiple days.
    d) View a schedule by day, week and month.
    e) Exception schedules and holidays shall be shown clearly on the calendar.
    f) Modify the schedule events, members and exceptions.
    g) Create schedules and exceptions for multiple buildings.
    h) Apply emergency schedule to multiple buildings
    i) Drag and drop scheduling editing
    j) Global schedule and exceptions across multiple buildings

16. Time of day scheduling
    a) Individual time schedules shall be provided for all areas and as listed below. The schedules for each area shall operate independently and shall be configured to meet the requirements of the Owner. The start time of each area shall be configured with optimum start times software functions, stop times shall follow a simple off time schedule.

Areas	**Approx. Occupied Time**
Office Areas	06:30 - 17:00
Classroom	07:00 - 15:00
Library	07:00 - 15:00
Toilet Room Exhaust Fans	06:00 - 20:00
Gymnasium	09:00 - 15:00
Auditorium	09:00 - 15:00
Kitchen	06:00 - 1500
Open Area	07:00 - 17:00

Note: General equipment associated with a particular area shall follow the area start/stop time schedule (i.e. – classroom general exhaust fans shall stop @ 15:00).

17. Data Logs
    a) Data Logs Definition
        (1) The Enterprise operator web interface shall allow a user with the appropriate security permissions to define a Data Log for any data in the system.
        (2) The Enterprise operator web interface shall allow a user to define any Data Log options as described in the Application and Control Software section.
        (3) Data Log viewing capabilities shall include the ability to show a minimum of 5 points on a chart.
        (4) Each data point data line shall be displayed as a unique color.
        (5) Data points can be hidden on the display view by clicking on the point.
        (6) The operator shall be able to specify the duration of historical data to view by scrolling, zooming, or selecting from a pull down list.
        (7) The system shall provide a graphical trace display of the associated time stamp and value for any selected point along the x-axis.
        (8) Operator will have the ability to show alarms and overrides on any data log view.

    b) Export Data Logs
        (1) The Enterprise operator web interface shall allow a user to export Data Log data in CSV, xlsx or text format for use by other industry standard word processing and spreadsheet packages.

C. Central Server – Components (Provide server as required)

1. The central physical or virtual server shall consist of the following (minimum):
2. System shall utilize a server class PC, tower or rack mounted.
3. Two 3.0 GHz, Quad Core
4. 8GB, DDR266 SDRAM memory
5. Hard Drive 73 GB
6. RAID 5 (recommended)
7. Microsoft Windows Server 2012/2014
8. Microsoft SQL Server 2008/2012
9. No Exception Taken Framework V3.5, 4.0
10. TCP/IP Interface

D. The central server shall provide the following applications within the system.

1. Trend Log Application
    a) The system shall automatically harvest trend logs for defined key measurements for each controlled MECHANICAL device and MECHANICAL application.
    b) The automatic trend logs shall monitor these parameters for a minimum of 30 days at 15 minute intervals. The automatic trend logs shall be user adjustable.

2. Site Management
    a) The system must allow for grouping of the many sites in an enterprise in a logical manner.
    b) The system shall provide a search function to allow users to search for sites or groups of sites by name or partial names.
    c) The system must provide the necessary means to add, remove, and manage site.

3. Automatic System Database Save and Restore
   a) The central server shall store on the hard disk backup tables of data including trends, alarms, custom settings and user profiles.
   b) The data shall be backed up once a day.
   c) This database shall be updated whenever a change is made in the system.
   d) The storage of this data shall be automatic and not require operator intervention.
   e) This capability is completed through SQL scheduled automated tasks for backup and only available in full SQL, and not SQL Express.

4. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database manually at any time.

5. System Configuration. The central server shall serve web pages as the interface for configuring the operator-level functions of the system. A user with proper security shall be able to configure the system to allow for future changes or additions.

E. Portable Operator's Terminal P.O.T (where indicated).: (Intended for portable field diagnostic tool.) Provide laptop computer with terminal emulation software to interface with DDC panels. Computer shall be Windows platform with latest stable windows operating system (Windows 8.1) integral pointing device. Furnish unit with all interface cards, cables, and software necessary to operate with DDC communications network, and to communicate directly with unit control panels. Furnish with (2) sets interface cables. Provide Windows 8.1 software. Schedule of laptop computer requirements:

Processing Chip	Pentium N3540, 2.5 GHz
RAM Memory	4 GB
Hard Drive	500 GB 5400 RPM
Two USB	USB 2.0 Ports and 3.0 Ports
Display	15” LED True Life HD
Video	HDMI Port
Sound	Maxx Audio
LAN Comm.	Ethernet Communications Board, 3COMM; or equal
Wireless Card	3-1 Memory Card Reader

F. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.

1. Scheduling. Provide the capability to schedule each object or group of objects in the system based off of the owner’s request. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:
   a) Weekly Schedule. Provide separate schedules for each day of the week.

   b) Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.

   c) Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

d) Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

2. Trend Log Application
   a) Trend log data shall be sampled and stored on the System Controller panel and shall capable of being archived to a BACnet Workstation for longer term storage.
   b) Trend logs shall include interval, start-time, and stop-time.
   c) Trend log intervals shall be configurable as frequently as 1 minute and as infrequently as 1 year.

3. Trend Logs
   a) The system controller shall create trend logs for defined key performance indicators for each controlled MECHANICAL device and MECHANICAL application.
   b) The trend logs shall monitor these parameters for a minimum of 7 days at 15 minute intervals. The automatic trend logs shall be user adjustable.

4. Alarm/Event Log
   a) Any object in the system shall be configurable to generate an alarm when transitioning in and out of a normal or fault state.
   b) Any object in the system shall allow the alarm limits, warning limits, states, and reactions to be configured for each object in the system.
   c) An alarm/event shall be capable of triggering any of the following actions:
      (1) Route the alarm/event to one or more alarm log
      (2) The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself.
      (3) Route an e-mail message to an operator(s).
      (4) Log a data point(s) for a period of time.
      (5) Run a custom control program.

5. Point Control. User shall have the option to set the update interval, minimum on/off time, event notification, custom programming on change of events.

6. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, building operator interface, or the local operator display. The amount of time that the override takes precedence will be selectable from the building operator interface.

7. Anti-Short Cycling. All binary output points shall be protected from short cycling.

8. Alarm/Event Notification:
   a) An operator shall be notified of new alarms/events as they occur while navigating through any part of the system via an alarm icon.

   b) The operator will have the option of selecting an audible alarm notification for all alarm classes they subscribe to.

   c) The system operator will have the option of setting specific times and days that that they will receive alarm notifications.

d) Provide software alarm points as listed below and as required by the Owner. Contractor shall meet with the Owner to include additional alarm point annunciation as requested by the Owner.

Point	**Alarm Function**
Hardware	Communication Failure Hardware Failure
Space Temperature	Out of Limits (± 5° from setpoint)
Duct Air Temperature	Out of Limits (± 10° from setpoint)
Water Flow Switch	Loss of Flow
Air Flow Switch	Loss of Flow
Water Temperature	Out of Limits (± 10° from setpoint)
Freeze Stat	Report Freeze Condition
Current Flow Switch	Loss of Current (Fan/Pump)

9. User Change Log. The operator shall be able to view all logged user changes in the system from any Enterprise operator web interface.
   a) An operator shall be able to group user changes by: date, affected, date & affected, user, date & user, transaction type, date & transaction type, or sort only.
   b) The operator will have the option of additional filtering capability of: date, transaction, type, user, affected, and details that can be used individually or in conjunction with other filters.

2.04 BUILDING CONTROLLERS

A. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in Application and Control Software section.

1. The System Controller shall have sufficient memory to support its operating system, database, and programming requirements.

2. The controller shall provide a USB communications port for connection to a PC.

3. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

4. All System Controllers shall have a real time clock.

5. Data shall be shared between networked System Controllers.

6. The System Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall.
   a) Assume a predetermined failure mode.

   b) Generate an alarm notification.

   c) Create a retrievable file of the state of all applicable memory locations at the time of the failure.

   d) Automatically reset the System Controller to return to a normal operating mode.

7. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at -40° C to 50° C [-40° F to 122° F].

8. Clock Synchronization:
   a) All System Controllers shall be able to synchronize with a NTP server for automatic time synchronization.

   b) All System Controllers shall be able to accept a BACnet time synchronization command for automatic time synchronization.

   c) All System Controllers shall automatically adjust for daylight savings time if applicable.

9. Serviceability
   a) Provide diagnostic LEDs for power, communications, and processor.

   b) The System Controller shall have a display on the main board that indicates the current operating mode of the controller.

   c) All wiring connections shall be made to field removable, modular terminal connectors.

   d) The System controller shall utilize standard DIN mounting methods for installation and replacement.

10. Memory. The System Controller shall maintain all BIOS and programming information indefinitely without power to the System controller.

11. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage.

12. BACnet Test Labs (BTL) Listing. Each System Controller shall be listed as a Building Controller (B-BC) by the BACnet Test Labs with a minimum BACnet Protocol Revision of 14.

2.05 ADVANCED APPLICATION CONTROLLERS

A. Advance Application Controllers shall be used to control all equipment or applications of medium and high complexity, including but not limited to Air Handlers, Boiler Plants and Chiller Plants.

B. For Stand-Alone Operation of Advanced Application Controllers:

1. Shall operate a schedule in a standalone application using a Real Time Clock with a 7 day power backup.
   a) The Controller shall have a built in schedule (assessable with or without a display).

   b) Support will be for at least 3 schedules with up to 10 events for each day of the week.

   c) Each of the 3 schedules can be Analog, Binary or Multi-State.

   d) The controller shall support a minimum of 25 exceptions each with up to 10 events.

C. For ease of troubleshooting, the Controller shall support data trend logging.

1. 25,000 samples minimum

2. Trends shall be capable of being collected at a minimum sample rate of once every second.

3. Trends shall be capable of being scheduled or triggered.

D. To meet the sequence of operation for each application, the Controller shall use library programs provided by the controller manufacturer that are either factory loaded or downloaded with service tool to the Controller.

E. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Storage conditions:
   a) Temperature: -67°F to 203°F (-55°C to 95°C).
   b) Humidity: Between 5% to 100% RH (non-condensing).

2. Operating conditions:
   a) Temperature: -40°F to 158°F (-40°C to 70°C)
   b) Humidity: Between 5% to 100% RH (non-condensing).

3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.

4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 158° F [-40° C to 70° C].

F. Input/Output: The Controller shall have on board or through expansion module all I/O capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment. In addition other controls must meet the following requirements.

1. Shall support flexibility in valve type, the controllers shall be capable of supporting the following valve control types: 0-10VDC, 0-5VDC, 4-20mA, 24VAC - 2 position.

2. Shall support flexibility in sensor type, the Controller shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, 50ms or longer pulses, 200 to 20Kohm and RTD input.

3. Shall support flexibility in sensor type, all Analog Outputs shall have the additional capability of being programmed to operate as Universal Inputs or Pulse Width Modulation Outputs.

4. Shall support flexibility in sensor type, the Controller and/or expansion modules shall support dry and wetted (24VAC) binary inputs.

5. The controller shall support pulse accumulator for connecting devices like energy meters.

6. In order to support a wide range of devices, the Controller's binary output shall be able to drive at least 10VA each.

7. Any unused I/O that is not needed for the functionality of the equipment shall be available to be used by custom programs on the Controller and by any other controller on the network.

8. The Controller shall provide 24VAC and 24VDC power terminals sensors and other devices required.

9. The Controller shall provide a dedicated static pressure input.

G. Input/Output Expandability – The Controller shall provide the following functionality in order to meet current and future application needs:

1. For the application flexibility, the Controller shall be capable of expanding to a total of at least 100 hardware I/O terminations.

2. Expansion I/O can be mounted up to 650 ft. (200m) from control.

3. Expansion I/O can be added in as small as 4 point increments.

4. To keep BACnet network traffic to a minimum, expansion I/O must communicate via an internal controller communication bus.

H. Serviceability – The Controller shall provide the following in order to improve serviceability of the Controller.

1. Diagnostic LEDs for power/normal operation/status, BACnet communications, sensor bus communications, and binary outputs. All wiring connections shall be clearly labeled and made to be field removable.

2. Binary and analog inputs and outputs shall use removable connectors or be connected to terminal strip external to the control box.

3. Software service tool connection through all of the following methods: direct cable connection to the Controller, connection through another controller on BACnet link and through the Controller's zone sensor.

4. For safety purposes, the controller shall be capable of being powered by a portable computer's USB port for the purposes of configuration, programming and testing programs so that this work can be accomplished with the power off to the associated equipment.

5. The Controller software tool service port shall utilize standard off-the-shelf USB printer cable.

6. Capabilities to temporarily override the BACnet point values with built-in time expiration in the Controller.

7. To aid in service replacement, the Controller shall easily attached to standard DIN rail mounting.

8. For future expansion, the Controller shall be capable of adding sequence of operation programming utilizing service tools software with a graphical programming interface (editing or programming in line code is not permissible).

9. To aid in service replacement, the Controller shall allow for setting its BACnet address via controller mounted rotary switches that correspond to the numerical value of the address. (DIP switch methodologies are not allowed). Setting of the address shall be accomplished without the need of a service tool or power applied to the controller.

10. Controller data shall be maintained through a power failure.

I. Software Retention: All Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

J. Transformer for the Controller must be rated at minimum of 115% of ASC power consumption, and shall be fused or current limiting type. 24 VAC, +/- 15% nominal, 50-60 Hz, 24 VA plus binary output loads for a maximum of 12 VA for each binary output.

K. Controller must meet the following Agency Compliance:

1. UL916 PAZX, Open Energy Management Equipment
2. UL94-5V, Flammability
3. FCC Part 15, Subpart B, Class B Limit
4. BACnet Testing Laboratory (BTL) Listed.

L. A Local Operator Touch Sensitive Display shall be provided for Central Plant and Air Handler Controllers at building locations where specified in the sequence of operations or point list.

2.06 APPLICATION-SPECIFIC CONTROLLERS

A. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.

1. Application Specific Controller are only allowed when both the following are met.
   a) The equipment is compressor based or boiler based.

   b) The controller is provided by the equipment manufacturer and warrantied as part of the equipment.

B. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.

1. Software
   a) To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.

   b) Stand-Alone Operation: Each piece of equipment specified in section “A” shall be controlled by a single controller and provide stand-alone control in the event of communication failure. In case of communications failure stand-alone operation shall use default values or last values for remote sensors read over the network such as outdoor air temperature.

   c) For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.

2. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
   a) Storage: -55° to 203° F and 5 to 95% Rh, non-condensing.

   b) Operating: -40° to 158° F and 5 to 95% Rh, non-condensing.

   c) Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.

d) Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F.

3. Input/Output:
   a) For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).

   b) For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.

   c) For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.

   d) For flexibility in selection and replacement devices, the controller's shall have binary output which are able to drive at least 12VA each.

   e) For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).

   f) For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.

   g) For future expansion and flexibility, the controller shall have either on board or through expansion, 20 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 650ft. (200 m) from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.

4. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
   a) Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
   b) All binary output shall have LED's indicating the output state.
   c) All wiring connectors shall removable without the use of a tool.
   d) Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link and through the controller's zone sensor.
   e) For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
   f) Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
   g) BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
   h) Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
   i) BACnet trending objects resident on controller.
      (1) Minimum of 20,000 trending points total on controller

(2) Shall be capable of trending all BACnet points used by controller
(3) Shall be capable of 1 second sample rates on all points

5. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

6. Transformer for the controller must be rated at minimum of 115% of ASC power consumption, and shall be fused or current limiting type. 24 VAC, +/- 15% nominal, 50-60 Hz, 24 VA plus binary output loads, for a maximum of 12 VA for each binary output.

7. Agency Approval: The controller shall have meet the Agency Compliance:
a) UL916 PAZX, Open Energy Management Equipment
b) UL94-5V, Flammability
c) FCC Part 15, Subpart B, Class B Limit

2.07 INPUT / OUTPUT INTERFACE

A. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.

B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.

D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.

E. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or normally closed operation.

G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.08 POWER SUPPLIES

A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
   a. Line voltage units shall be UL recognized and CSA approved.

2.09 AUXILIARY CONTROL DEVICES

A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

1. (**D-1**): Opposed blade damper.

2. (**D-2**): Parallel blade damper.

3. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.

4. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.

5. Damper shaft bearings shall be as recommended by manufacturer for application.

6. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.

7. All leakage testing and pressure ratings will be based on AMCA Publication 500.

8. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.

9. Control dampers shall be parallel or opposed blade types as scheduled on drawings.

10. Acceptable Manufacturer shall be Ruskin, Greenheck, or equal.

B. Electric damper/valve actuators (**ME-1, ME-2, ME-3)**

1. ME-1: Modulating range.

2. ME-2: Two Position.

3. ME-3: Modulating range, for unit ventilators.

4. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

5. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.

6. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.

7. Actuators shall be Underwriters Laboratories Standard 873 listed.

8. Acceptable Manufacturer shall be Belimo or equal.

C. Control Valves

1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.

2. Size control valves according to chart below: (Maximum DP of 3 psi):

VALVE SIZE CHART

Max GPM	VALVE SIZE	CV
7.5	1/2”	4.4
13	3/4”	7.5
24	1”	14
35	1-1/4”	20
48	1-1/2”	28
69	2”	40
113	2-1/2”	65
156	3”	156
294	4”	294

3. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
   a) Water Valves:
      (1) Two-way: 150% of total system (pump) head.
      (2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

   b) Steam Valves: 150% of operating (inlet) pressure.

4. Water Valves
   a) Body and trim style and materials shall be in accordance with manufacturer’s recommendations for design conditions and service shown, with equal percentage ports for modulating service.

   b) Sizing Criteria.
      (1) (**CVT**) Two-position service.
      (2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 3 psi, whichever is greater.
      (3) (**CVM, CVZM**) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 3 psi maximum.

(4) Valves (1/2 in.) through (2 in.) shall be bronze body or cast brass ANSI Class 250, spring-return, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless steel ball, 23°F - 250°F.

(5) Valves (2 1/2 in.) and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing, globe valve.

(6) Never provide a controls valve that is less than half the size of the supply line serving that sytem.

c) Terminal Unit Zone valves shall be sized to meet the control application and they shall be spring return so in the event of a power failure, they will go to full open.

5. Acceptable Manufacturer shall be Belimo; or equal.

D. Binary Temperature Devices (**THL-1)**

1. Low-voltage space thermostat shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover. Acceptable Manufacturer shall be Honeywell; or equal.

2. Line-voltage space thermostat shall be bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover. Acceptable Manufacturer shall be Honeywell; or equal.

E. Temperature Sensors (**TSB, TSR, TSD, TSDA, TS/HS)**

1. TSB: Flat plate thermistor room sensor. ACI R2; or equal.

2. TSR: Room sensor with LCD display and setpoint adjustability. ZS Pro-M, Automated Logic; or equal.

3. TSD/TSDA: duct mounted sensor.

4. TS/HS: Combination temperature and humidity sensor. A/RH1; Automation Components, Inc.

5. Combination Temperature and Humidity sensor.

6. Temperature sensors shall be RTD or thermistor.
   a) Wireless space sensor component certifications shall include:
      (1) UL 916 - Energy Management Equipment.
      (2) UL 94 - The Standard for Flammability of Plastic Materials for Parts in Devices and Appliances.
      (3) UL 873 - Temperature regulating and indicating equipment.
   b) The wireless space sensor battery life shall provide at least 15 years life under normal operating conditions and must be readily available size AA, 1.5V.

7. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m2 (10 ft2) of duct cross section.

8. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.

9. Space sensors shall be equipped with setpoint adjustment, override, display, and/or communication port as shown on plans.

10. Provide matched temperature sensors for differential temperature measurement.

F. Humidity Sensors (**HSTS-wall mount / HSP-duct mount**)

1. Space Humidity Sensors shall have a sensing range of 20% to 80% with accuracy of +/- 2% RH.

2. Duct Sensors and Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH with an accuracy of +/- 2% RH.

3. Humidity sensor's drift shall not exceed 1% of full scale per year.

4. Acceptable Manufacturer shall be Omega; or equal.

G. End Switch (ES-1)

1. Proof of closure of damper. Kele; or equal.

H. Pressure Sensors (**DPT-1)**

1. Air pressure of differential pressure measurements in the range of 0 to 10" water column shall be accurate to +/- 1% of range. Acceptable Manufacturer shall be Setra; or equal.

2. Liquid pressure or differential liquid pressure measurements shall be accurate to +/- 0.25% of range. Unit shall be provided with isolation and bypass manifold for startup and maintenance operations. Acceptable Manufacturer shall be Setra; or equal.

I. Low Limit Thermostats (**LC-1)**

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section. Acceptable Manufacturer shall be Honeywell; or equal.

2. Low limit shall be manual reset only.

J. Carbon Dioxide Sensors (**CDS-1)**

1. Carbon Dioxide sensors shall measure CO2 in PPM in a range of 50 ppm with drift not to exceed 20 ppm. Sensors shall be duct or space mounted as indicated in the sequence of operation.

2. Acceptable Manufacturer shall be Dwyer; or equal.

K. Flow Switches (**FS-1)**

1. Flow-proving switches shall be either paddle or differential pressure type.

2. Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125VA minimum) and shall have adjustable sensitivity with NEMA 1 enclosure unless otherwise specified. Manufacturer shall be Setra; or equal.

3. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as specified. Acceptable Manufacturer shall be Setra; or equal.

L. Air Flow Probes (**AF-1)**

1. Provide an array of airflow traverse probes where indicated, capable of continuously monitoring the fan or duct capacities (CFM) they serve. Each airflow traverse probe shall contain multiple total and static pressure sensors located along the exterior surface of the cylindrical probe and internally connected to their respective averaging manifolds. The flow sensors shall not protrude beyond the surface of the probe(s), and shall be the offset type for static pressure and the chamfered impact type for total pressure measurement. The airflow sensing probe's measurement accuracy shall not be affected by directional flow having pitch and/or yaw angles up to 30°. Each airflow traverse probe shall be of extruded aluminum construction and furnished with mounting plate(s), gasket and signal fittings suitable for MECHANICAL duct installation.

2. The airflow traverse probe shall not induce a pressure drop in excess of 0.03" w.c. at 2000 FPM, nor measurably contribute to sound levels within the duct. Total and static pressure sensors shall be located at the centers of equal areas (for rectangular duct) or at equal concentric area centers (for circular ducts) along the probe length. The airflow traverse probe shall be capable of producing steady, non-pulsating signals of total and static pressure without need for flow corrections or factors, with an accuracy of 2-3% of actual flow, over a velocity range of 400 to 4000 FPM.

3. Provide the minimum number of probes indicated: Duct height 8 – 12", 1 probe; 13 – 30", 2 probes; 31 – 54", 3 probes; 55 – 84", 4 probes; 85 – 120", 5 probes; 121 – 180", 6 probes.

4. The airflow traverse probe shall be the VOLU-probe as manufactured by Air Monitor Corporation, or equivalent.

M. Hydronic Flow Meters (**FM-3**)

1. Insertion-Type Turbine Meter
   a) Insertion type, complete with hot-tap isolation valves to enable sensor removal without water supply system shutdown.

   b) Liquide flow measurement devices shall be accurate to +/- 1% over a turn down ratio of 10:1.

   c) Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards.

   d) All wetted metal parts shall be constructed of 316 stainless steel.

   e) Analog outputs shall consist of non-interactive zero and span adjustments, a DC linearly of 0.1% of span, voltage output of 0–10 Vdc, and current output of 4–20 mA.

   f) Acceptable Manufacturer shall be Onicon; or equal.

N. Relays (**CR-1)**

1. Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time delay relays shall be UL listed solidstate plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

3. Acceptable Manufacturer shall be Functional Device Inc;. or equal.

O. Transformers and Power Supplies

1. Control transformers (**XT-1**) shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.

2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.

3. Unit shall be UL recognized.

4. Acceptable Manufacturer shall be Functional Device Inc.; or equal.

P. Current Switches (**CFS-1)**

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

2. Acceptable Manufacturer shall be Functional Device Inc.; or equal.

Q. Immersion Temperature Sensor (**ITS, ITS-1)**

1. Furnish with brass thermowell. Well insertion length to center of pipe. Glycol system require stainless steel well. ACI; or equal.

R. Motion Detector (**MDS-1**)

1. Ultra- sonic type omni directional transmitter, dual receivers, sensitivity gain control, 600 sq. ft. coverage, 24 Volt DC, Universal Energy Control Inc.; or approved equal.

S. Static Pressure Sensor (**SPS-1, SPNL-1)**

1. Model 264, pressure transmitter 4-20mA, 0-5VDC, 2.5VDC bidirectional output, 24VDC power by this Contractor, range 0-1.0" wg. or as applicable to individual systems needs. Setra; or approved equal.

T. Current transmitters

1. AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and ±1% full-scale accuracy at 500 ohm maximum burden.

2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.

3. Unit shall be split-core type for clamp-on installation on existing wiring.

4. Acceptable Manufacturer shall be Functional Device Inc. or equal.

U. Power Monitors

1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0 amp current inputs or 0–0.33 volt inputs.

2. 1.0% full-scale true RMS power accuracy, +0.5 Hz, voltage input range 120–600V, and auto range select.

3. Under voltage/phase monitor circuitry.

4. NEMA 1 enclosure.

5. Current transformers having a 0.5% FS accuracy, 600 VAC isolation voltage with 0 - 0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/ shorting switch assembly is required.

6. Acceptable Manufacturer shall be Allen-Bradley; or equal.

V. Push Button (**PB-1)**

1. Flush mount, stainless steel plate, mushroom head, contact block with red nameplate, white lettering to identify fan and purpose.

W. Thermal Energy Meters

1. Matched RTD or thermistor temperature sensors with a differential temperature accuracy of ±0.15°F.

2. Flow meter that is accurate within ±1% at calibrated typical flow rate and does not exceed ±2% of actual reading over an extended 50:1 turndown range.

3. Unit accuracy of ±1%

4. NEMA 1 enclosure.

5. UL listed.

6. Isolated 4–20 ma signals for energy rate and supply and return temperatures and flow.

7. Acceptable Manufacturer shall be Onicon; or equal.

X. Carbon Monoxide Sensor (**CDS-1**)

1. Wall mounted Carbon Monoxide Sensor (CO) shall monitor CO over a range of 0-300 PPM.

2. The device shall have an accuracy of +/- 3% and operate within the range of 32-110 deg F and 0-95% RH.

3. Acceptable Manufacturer shall be Honeywell; or equal.

Y. Local Control Panels (**TCP, TCP-1)**

1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.

2. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide on/off power switch with over-current protection for control power sources to each local panel.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The BAS manufacturer shall inspect the jobsite in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.02 PROTECTION

A. The BAS installation contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.

B. The BAS manufacturer shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.03 COORDINATION

A. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.

2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

B. Submittals. Refer to the “Submittals,” section of this specification for requirements.

C. Test and Balance

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

2. The contractor shall provide training in the use of these tools. This training will be planned for a duration of 4 hours.

3. The tools used during the test and balance process shall be returned to the contractor at the completion of the testing and balancing.

D. Life Safety

1. Duct smoke detectors required for air handler shutdown shall be supplied under Division 26 contract. The contractor shall interlock smoke detectors to air handlers for shutdown as described in the Sequences of Operation for this project.

E. Coordination with Controls Specified in Other Sections or Divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

1. All communication media and equipment shall be provided as specified in the “Communication” section of this specification.

2. Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

F. Fire Alarm: Provide interface card to allow communications between temperature control network and fire alarm system. Coordinate exact requirements with Electrical Contractor. Provide all hardware and software necessary for full seamless interface. Show fire alarm failure on graphics.

3.04 GENERAL WORKMANSHIP

A. Install equipment, piping, wiring/conduit, parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible locations as defined by National Electric Code (NEC). Control panels shall be attached to structural walls or properly supported in a free-standing configuration, unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

D. Verify integrity of all control wiring to ensure continuity and freedom from shorts and grounds prior to commencing the startup and commissioning procedures.

E. All control device installation and wiring shall comply with Contract Documents, acceptable industry specifications, and industry standards for performance, reliability, and compatibility. Installation and wiring shall be executed in strict adherence to local codes and standard practices referenced in Contract Documents.

3.05 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Contract Documents.

B. BAS manufacturer shall continually monitor the field installation for building code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.

C. BAS installing Contractor(s) shall arrange for field inspections by local and/or state authorities having jurisdiction over the wor.

3.06 WIRING

A. All control and interlock wiring shall comply with the National, Local Electrical Codes, and Divison 26 of these Contract Document specifications.

B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to NEC requirements.

C. All wiring in plenum spaces shall be enclosed in conduit. Plenum rated cable can be used in accessible ceilings.

D. Where Class 2 wires are in concealed and accessible locations; including ceiling return air plenums, approved cables outside of electrical raceway can be used provided that the following conditions are met:

1. Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

2. All cables shall be UL listed for application (i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose).

3. Line Voltage Control Wiring:
   a) For control relays or other low amperage circuits #14 AWG THHN.

   b) For direct line voltage control of equipment minimum conductor size #12 AWG THHN.

   c) Electronic Sensor Wiring: 18 AWG, stranded (16x30) copper conductors, twisted pair, 100% overall aluminum polyester shield, 20 AWG CU drain wire. Polyethylene insulation, PVC jacket, 300V, 60°C. Furnish Belden; or equal.

   d) Computer Communications Cable: 18 AWG, stranded (16x30) copper conductors, (2) twisted pair, 100% individual aluminum polyester shields each shield with 20 AWG CU drain wire. PVC insulated, PVC jacket, 300V. Furnish Belden; or equal. Note: Actual # of conductors may be increased as required for actual communication requirement.

4. Provide minimum (1) spare shielded twisted pair conductors in each communications wiring run. Wiring runs between operator work stations (if any) provide (2) spare shielded twisted pair conductors.

E. Do not install Class 2 wiring in conduits containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two via control relays and transformers.

F. Where Class 2 wiring is run exposed, wiring shall be conduit

G. Maximum allowable voltage for control wiring shall be 120Vac. If only higher voltages are available for use, the BAS manufacturer shall provide step-down transformers to achieve the desired control voltages.

H. All control wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.

I. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with Contract Documents and National and/or Local Codes.

J. Conduit and wire sizing shall be determined by the BAS manufacturer in order to maintain manufacturer's recommendation and meet National and Local Codes.

K. Conduit Routing and termination

1. Conduits shall be installed so as to be concealed in all finished spaces at the conclusion of the project unless otherwise noted. Conduits may be exposed in mechanical and electrical rooms and unfinished storage, maintenance and production areas.

2. Where it is impractical to conceal wiring or conduit in finished construction, cables shall be run in wiremold.

3. Make neat runs parallel or perpendicular to structural elements (walls, ceilings, floors) of building with minimum number of couplings and bends. Install so that required conductors may be drawn without injury or excessive strain.

4. Provide double locknuts and insulation bushings on the end of each conduit entering an enclosure. If smaller holes are used in knockouts provide listed devices which overlap largest knockouts as required to strengthen the termination.

5. Cap or plug open ends of conduits during construction.

6. Conduits shall be continuous from equipment controls to cabinets, junction or pull boxes and shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous.

7. Change in Direction of Conduit:
   a) Concealed locations - use standard radius bend.

   b) Exposed locations or concealed locations where conduit will be accessible; use standard radius bends or conduit body.

8. Install conduits to allow proper drainage. Do not form pockets.

9. Securely attach all conduits to building structure utilizing approved methods and fastening devices for support.

10. Clear obstructions in raceways or replace raceways at no additional contract cost. Demonstrate to Architect that spare conduits are free of obstruction at substantial completion and leave a drag line (1/8" polypropylene monofilament utility rope) for future use.

L. Follow manufacturer's installation recommendations for all communication and network bus cabling. Network or communication cabling shall be run separately from all control power wiring.

M. Adhere to the Division 26 requirements for installation of electrical raceways.

N. BAS manufacturer shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

O. Flexible metal conduits and liquid-tight flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.

P. Penetrations:

1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways. All other project fire stopping to be by other trade.

2. All openings in the fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

3. All wiring passing through penetrations, including walls, shall be in conduit or enclosed raceway.

4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true and square.

5. No penetrations in structural elements shall be made before receipt of written approval from Engineer and/or Architect.

Q. BMS Raceway:

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 3/4".

2. Where it is not possible to conceal raceways in finished locations, surface raceway (wiremold) may be used as approved by the Engineer.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

4. Flexible metal conduit shall be used for vibration isolation and shall be limited to 3' in length when terminating to vibrating equipment. Flexible metal conduit may be used within partition walls. Flexible metal conduit shall be UL listed.

3.07 COMMUNICATION WIRING

A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer’s installation recommendations for all communication cabling.

B. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer shall not be exceeded during installation.

D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.

E. When a cable enters or exits a building, a lighting arrestor must be installed between the line and ground.

F. All runs of communication wiring shall be unspliced length when the length is commercially available.

G. All communication wiring shall be labeled to indicate origin and destination.

3.08 FIBER OPTIC CABLE

A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.

C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.09 INSTALLATION OF SENSORS

A. Sensors required for mechanical equipment operation shall be factory installed and wired as specified in mechanical equipment specifications. BAS manufacturer shall be responsible for coordinating these control devices and ensuring the sequence of operations will be met. Installation and wiring shall be in accordance with the BAS manufacturer's recommendations.

B. Sensors that require field mounting shall meet the BAS manufacturer’s recommendations and be coordinated with the mechanical equipment they will be associated.

C. Mount sensors rigidly and adequately for the environment the sensor will operate.

D. Room temperature sensors shall be installed on concealed junction boxes properly supported by the block wall framing. For installation in dry wall ceilings, the low voltage sensor wiring can be installed exposed and must meet applicable National and Local Electrical Codes.

E. All wires attached to wall mounted sensors shall be sealed off to prevent air from transmitting in the associated conduit and affecting the room sensor readings.

F. Install duct static pressure tap with tube end facing directly down-stream of air flow.

G. Install space static pressure sensor with static sensing probe applicable for space installation where applicable.

H. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

I. All pipe mounted temperature sensors shall be installed in matched thermowells. Install all liquid temperature sensors with heat conducting fluid in thermal wells for adequate thermal conductance.

J. Wiring for space sensors shall be concealed in building drywall. EMT conduit is acceptable within mechanical equipment and service rooms.

K. Install outdoor air temperature sensors on north wall complete with sun shield at manufacturer's recommended location and coordinated with Engineer.

3.10 IDENTIFICATION OF HARDWARE AND WIRING

A. All field wiring and cabling, including that within factory mounted, and wired control panels and devices for mechanical equipment, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information for troubleshooting, maintenance, and service purposes. BAS manufacturer to coordinate this labeling requirement with mechanical equipment manufacturer as it relates to controls.

B. Permanently label or code each point of field terminal strips to show the instrument or item served and correlate them to the BAS design drawings.

C. Identify control panels with plastic nameplates.

3.11 GROUNDING AND BONDING

A. Equipment Grounding Conductors: All metallic non-current carrying parts of electrical equipment shall be grounded with equipment grounding conductors whether or not shown on the drawings. Equipment grounding conductors shall be green insulated copper conductors unless otherwise indicated.

1. Install green, equipment grounding conductor with all feeder and branch circuit conductors.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3. Enclosures: Ground all enclosures of electrical and electronic wiring and distribution equipment in accordance with requirements of the NEC Article 250.

4. Equipment Enclosure Grounding: Bare wire, wrapped around connecting screws or mounting bolts and screws is not acceptable as a grounding connection. All ground lugs shall be of a noncorrosive material suitable for use as a grounding connection, and must be compatible with the type of metal being grounded. Ground lugs shall be mounted on clean, bare metal surfaces that are free of paint, rust, etc. Wire brush clean each surface to remove paint or oxidation prior to bolting jumper connectors in place. In general use tinned copper connectors for connections of dissimilar metals. Use of bimetal connectors shall only be allowed in special circumstances and only with the prior written approval.

3.12 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis 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 assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Terminate insulated equipment grounding conductors for feeders with pressure-type grounding lugs. Where metallic raceways terminate at non-metallic or non-conductive housings, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

C. Raceway Grounding: Surface metal raceways, wireways, or cable trays or cable rack systems shall be installed in a manner that ensures electrical continuity. Short insulated green copper bonding jumpers shall be installed between adjacent raceway sections, on both sides of each joint, to ensure proper bonding. Unless otherwise indicated, the minimum size for these bonding jumpers shall be No. 6 AWG. Jumpers shall be provided with compression connectors at each end of cable. Surface metal raceways, wireways, cable trays or cable rack systems shall be field drilled to provide bolting point for securing bonding jumper. Wire brush clean each surface to remove paint or oxidation prior to bolting jumper connectors in place. Bolts and hardware shall be as per details or as approved for grounding purposes. All metallic raceway penetrations into a facility structure shall be bonded to the earth electrode system.

D. Other Grounding Systems: Any additional grounding systems used for electronic equipment shall be connected to the facility main ground plate, structural steel or exterior earth electrode system as shown on drawings.

E. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with torque tightening values specified in UL 486A.

3.13 CONTROL SYSTEM CHECKOUT AND TESTING

A. Acceptance Check Sheet:

1. The contractor shall prepare check commissioning sheets that include all points for all functions of each system as indicated on the temperature controls submittal documents.

2. Submit the check sheets to the engineer for approval within the temperature controls submittal documents.

3. Engineer will use the approved check sheets as the basis for acceptance of the BAS.

4. The contractor is perform complete commissioning reports for this project. Prior to final payment, contractor must submit signed commissioning checklist, approved by both the owner and engineer. The contractor must also prepare commissioning reports for each piece of equipment that is being controlled.

B. Start-up testing. All testing in this section shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner’s representative is notified of the system demonstration.

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all of the instruments, controls, and accessory equipment furnished under this specification.

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturer's recommendations.

4. Verify all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starter, etc.) operate properly and normal positions are correct.

5. Verify all analog output devices (I/Ps, actuators, etc) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

6. Verify the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimal start/stop routines.

7. Alarms and Interlocks
   a) Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

   b) Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction,

   c) Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

C. Start-up testing. All testing in this section shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.

3.14 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Acceptance: The BAS will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

3.15 TRAINING

A. Provide minimum of 2 classroom training sessions, and 4 hours for each session, throughout the contract period. The training will be provided for personnel designated by the Owner.

B. Provide course outline and materials prior to schedule training session. The instructor(s) shall provide one copy of training material per student.

C. The instructor(s) shall be factory-trained and experienced in teaching this technical material.

END OF SECTION

SECTION 232100 - WATER SYSTEM SPECIALTIES AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawing and General Provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 SUBMITTALS

A. Schedule of all materials used.
B. Product data for all specialties.

1.03 GENERAL REQUIREMENTS

A. All equipment and accessories in this section shall be rated for a least 125 psi wwp, and 250°F minimum temperatures, unless otherwise specified.
B. Manufacturer's written installation procedures shall become a part of these specifications.
C. All terminal water system specialties and equipment shall be line size.

PART 2 - PRODUCTS

2.01 WATER SYSTEM SPECIALTIES AND EQUIPMENT

A. AF-1: High capacity air vent; float actuated non-modulating. Positive shut off up to 150 psig and a maximum temp. of 250°F. Cast Iron construction with internal components of Type 313 stainless steel, brass, Buna-N and silicone rubber. Bell & Gossett, Model #107; or equal.

B. AV-1: Air bleed valve, at each high point or air pocket in water piping systems, 1/8" NPT size, brass body, key operated, extension tube if required. 150 working pressure and 225ºF operating temperature. Bell & Gossett Model #4V; or equal.

C. AV-2: Air eliminator 3/4" inlet, normally open, float actuated valve. Cast iron construction with stainless steel float, valve head and float. Provide 3/8" relief tube to 6" AFF. Model #13 W; Spirax Sarco, Inc.; or equal.

D. SS-1: Pipeline strainer, line size up to 2", screwed cast bronze body, 20 mesh stainless steel screen, for liquid or steam service. S.W.P. 125 lbs at 400°F. Series #777S, Watts Regulator Co.; or equal. Note: Provide ball valve BV-1 and hose connections for blow-down.

E. TH-1: Thermometer, cast aluminum case and adjustable joint, copper plated steel bulb chambers, separable brass socket, range 30°F to 240°F. Weiss Instruments, Inc. Vari-angle, Model #9VS6; or equal.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. All equipment and systems as shown on the drawings or specified herein shall be installed in accordance with the provisions of each applicable section of these specifications.

B. Obtain detailed written or graphical instruction from each manufacturer for proper method of installing each piece of equipment.

C. Provide reducers where required to adapt water system specialties to piping system.

D. Provide all supporting steelwork, hangers, and suspension racks as required, and support as approved by Architects.

3.02 SYSTEM FILLING

A. After cleaning, fill each system from low point:

1. With pumps off, vent all mains, risers, runouts, units, etc., working consecutively from low to high point in building. Obtain approximately 2 psi at highest point. Obtain proper air cushion in compression tanks. Vent all released air and gases at all vent points. Check high level in compression tanks; drain if necessary.

3.03 AIR VENTING

A. Provide vents at all points in piping system where air may collect. Provide one of the following:

1. Manual vent assembly consisting of: 1-1/4" x 6" air collection chamber, 1/4" brass globe valve in accessible location, install hose connection to valve outlet.
2. Automatic vent with air chamber.

3.04 EQUIPMENT VENTS

A. When Equipment is Above Mains: Connect runouts or risers to upper quadrant or top of mains. Install vent assembly concealed within enclosure, consisting of 1" diameter by 4" to 6" long air collection chamber with 1/4" soft copper tube to manual valve. Mount securely near bottom of enclosure, but not fastened to enclosure. For individual units, provide screwdriver.

B. When Equipment is Below Mains: Connect piping runouts or risers to bottom or lower quadrant of mains. Vent assembly not required in unit. Provide means of purging and draining each unit, if required. Use tees instead of elbows at low point of runouts.

3.05 STRAINERS

A. Provide approved valved dirt blow-off connection for strainers, size 6" and larger. Equip with quick opening gate valve and brass plug. Valve located 6" to 12" below strainer or as approved, full size of tapping. Provide discharge piping if required for protection, when directed by Architects or shown on plans.

1. Note: strainer to be mounted horizontally.

END OF SECTION

SECTION 232113 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. Schedule of pipe and fittings.
B. Product data for all materials.
C. Test reports.

1.03 REFERENCE STANDARDS AND CODES

A. All installations and materials shall conform to applicable 2016 New York State Building code, and local building and plumbing codes.

B. All piping shall be inspected and approved by Underwriters Laboratories and bear the UL label.

C. All installations shall conform to requirements of Owner's Insurance carriers.

D. Refer to the latest edition and applicable sections of the following:

1. American Society of Testing and Materials (ASTM)
2. American National Standards Institute (ANSI)
3. American Society of Mechanical Engineering (ASME)
4. Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
5. Boiler and Pressure Vessel Code, Section VIII, Division 1 - Pressure.
6. Boiler and Pressure Vessel Code, Section IV, Heating Boilers.
7. Code for Pressure Piping B31.9 - Building Services Piping.
8. American Welding Society (AWS).
9. National Fire Protection Association (NFPA)
10. National Electrical Manufacturer's Association (NEMA)
11. "Maximum allowable natural gas pressure: gas pressures within boiler rooms shall not exceed a maximum of 2 psig; gas pressures within buildings (other than boiler rooms) shall not exceed a maximum of 0.5 psig."

1.04 GENERAL REQUIREMENTS

A. All materials furnished and all installations made under this specification shall conform with the applicable requirements of the codes and standards described herein.

B. Layout of equipment, piping, etc. is diagrammatic, unless detailed. Check project drawings prior to making installations for interference's with other trades and services. Owner reserves the right to make reasonable changes prior to "rough-in" without added expense. All dimensions shown are subject to verification of exact site conditions.

C. Have any required local or municipal inspection processed and present to Owner with certificate indicating approval of such governing body.

D. Furnish and install all brackets, anchors, sleeves, seals and/or supports as required for the MECHANICAL installations. Where detail is not shown, submit shop drawings of intended construction for approval.

E. All work to be performed in cooperation with the Owner. Coordinate construction schedule with the Owner. Report delays in material receipt immediately to Owner indicating full circumstances concerning delay.

F. Piping systems shall be presented to the Owner complete, in perfect working order, tested in full accordance with the Contract Documents. All work associated with the installations shall be guaranteed in complete accordance with the Contract Documents.

G. Perform all testing as required and as specified herein.

PART 2 - PRODUCTS

2.01 PIPE

A. Heating Hot Water (2" & Below):

1. Type L, seamless hard drawn temper copper tube, ASTM B-88; wrought copper socket fittings, unions, ANSI B16.22; threaded valve connections, solder joints shall be 95-5 tin to antimony solder, conforming to ASTM B-32.

2. Type L, seamless hard drawn temper copper tube, ASTM B-88; unions, ANSI B16.22. For use with mechanically joined fittings.

B. Condensate Drain (1" & Below): Type M, hard drawn copper tube, ASTM B-88; wrought copper socket fittings, unions, ANSI B16.22; solder joints shall be 50/50 tin to lead solder, conforming to ASTM B-32.

2.02 FITTINGS

A. 2” and Smaller – Copper Pipe Mechanically Joined Fittings:

1. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements shall be factory installed EPDM. Fittings shall be rated for an operating pressure of 200PSI and operating temperature range of 0°F to 250°F
2. Manufacturer shall warranty fittings to be free from failure caused by manufacturing defect for a period of 50 years from date of installation.
3. Fittings shall not be allowed for use in below grade/direct buried application, or exposed outside of building envelope.
4. Fittings shall be Viega ProPress or equal

2.03 IDENTIFICATION

A. Pipe Identification Markers: Furnish and install pipe identification markers on all piping installed under this contract. It shall consist of self-adhesive labels of black letters imprinted on color coded backgrounds indicating pipe fill and direction of flow. Lettering shall be 2" high on pipes 3" diameter and over and 3/4" high on pipes under 3". Markers shall be applied to pipe, or to insulation in case of insulated pipes, on 15' centers and at each valve, whichever is closer. Color code as follows:

	Legend	Background
a)	Heating Hot Water	Yellow
b)	Condensate Drain	Green
c)	Refrigeration Piping	Green

B. All pipe identification colors shall conform to ANSI Standard A-13.1. Pipe identification markers shall be vinyl cloth, 0.0085" thick, Seton Nameplate Corp., Setmark Type; or equal.

C. Nameplates: Identify each valve, control entity or piece of equipment with stamped brass or engraved plastic nameplate permanently attached by riveting, wiring, etc. Set up complete identification system in cooperation with Owner's Physical Plant/Maintenance Department. Each drain plug or valve shall be tagged "DRAIN". Furnish and install engraved rigid laminated plastic nameplate to identify function of each control item on temperature control panel. Remote operating control switches shall have engraved faceplates to indicate function and/or operation controlled. Embossed and/or pressure sensitive plastic tape labels shall not be acceptable. Furnish engraved 2" x 1" black rigid laminated plastic nameplate for each motor starter furnished for mechanical equipment and present with motor starter to EC for mounting.

2.04 PIPING HANGER SYSTEMS

A. Heating System Pipe Hangers: Furnish cast iron single pipe roll hangers, carbon steel clevis hangers, carbon steel copper plated hanger, as required for proper installation. Furnish C Type beam clamps, carbon steel electro-galvanized continuous threaded rod and accessories as required. Furnish as manufactured by Elcen Metal Products Co., Michigan Hanger Co., Inc.; or an approved equal.

B. Non-Insulated System Pipe Hangers: Furnish clevis ring pipe hanger, carbon steel electro-galvanized finish, Model #401. Furnish steel c-clamps, continuous threaded rod and accessories.

C. Furnish trapeze hanger system in addition or in place of hanger systems above as detailed on drawings.

2.05 TEE CONNECTIONS

A. Two sizes or more smaller than main run in steel pipe, make with Bonney Forge, Inc., Weldolets or Threadolets; or equal. Copper tube run-out piping thus connected to steel mains shall be by means of bronze threaded adapter threaded into Threadolet.

2.06 LIABILITY

A. Contractor shall be held liable throughout guarantee period for any damage from failure of piping due to poor or faulty workmanship and/or defective materials.

2.07 STEEL PIPE HANGERS

A. Horizontal runs of pipe shall be securely held in place by means of suitable hangers. In general, hanger shall be clevis type with threaded rod supports. Chain or cold rolled flat steel straps are not acceptable. Supports shall be spaced according to the following schedule:

	Pipe Size	Maximum Spacing	Minimum Rod Size
1.	3/4 in.	5 ft.	3/8"
2.	1 in.	6 ft.	3/8"
3.	1-1/4 in.	6 ft.	3/8"
4.	1-1/2 in.	8 ft.	3/8"
5.	2 in.	10 ft.	3/8"
6.	2-1/2 in.	11 ft.	1/2"
7.	3 in.	12 ft.	1/2"
8.	4 in.	12 ft.	5/8"

B. Heating piping hangers shall be applied directly to piping. Cut-out insulation for hanger and cover with jacketing. Insulation shall be "butt-up" to hanger as tightly as possible.

C. Where Piping is Supported From Open Web Steel Joists, and Running Perpendicular to the Joists:

1. Reduce the maximum hanger spacing for 8" pipe from 12 feet to 8 feet. Where two 6" or 8" pipes are running side by side, stagger the hangers so only the load from one pipe is applied to a joist. Where two 6" and two 8" pipes are running side by side, reduce the maximum hanger spacing for 6" pipe from 12 feet to 8 feet and for 8" pipe from 12 feet to 6 feet, and stagger the hangers so that no more than one 6" pipe and one 8" pipe are supported from a single joist. Where possible, support from steel beams or girders.

D. Where Piping is Supported From Open Web Steel Joists, and Running Parallel to the Joists:

1. Reduce the maximum hanger spacing for 6" pipe from 12 feet to 10 feet and for 8" pipe from 12 feet to 8 feet. Where two 6" or 8" pipes are running side by side, stagger the hangers so only the load from one pipe is applied to each support location. Where two 6" and two 8" pipes are running side by side or where four 6" inch pipes are running side by side, reduce the maximum hanger spacing for 6" pipe from 12 feet to 8 feet and for 8" pipe from 12 feet to 6 feet, span unistrut supports between at least three joists, and stagger the hangers so that no more than two pipes are supported at each support point. Where possible, support from steel beams or girders.

2.08 COPPER TUBE HANGERS

A. Pipe hangers for copper tube shall be copper plated hanger rings.

2.09 SLEEVES

A. Pipes passing through masonry construction shall be fitted with sleeves. Each horizontal sleeve shall extend through its respective wall and be flush with each surface. Each vertical sleeve shall extend through its respective floor slab, be flush with underside of slab, and extend 1/2" above top of finished slab. Sleeves shall be two pipe sizes larger than uninsulated lines and one pipe size larger than overall diameter of insulated lines.

B. See Section 230005 - MECHANICAL Work General; for penetration requirements through fire rated partitions, walls, floors etc.

2.10 PIPE ENCLOSURES

A. 16 GA metal piping enclosures by Sterling. Provide mounting strip and angle supports. Refer to drawings for three sided vertical (model #PCV) two sided vertical (model #PCV) or horizontal (model #PCH) enclosures. Color selection by architect.

VERTICAL PIPE ENCLOSURE			
PIPE SIZE (IN)	NUMBER OF PIPES	INSULATION THICKNESS	PIPE ENCLOSURE SIZE (IN)
3/4	2	1-1/2	10x5
1	2	1-1/2	10x5
1-1/4	2	1-1/2	10x5
1-1/2	2	2	12x6
2	2	2	14x8
2-1/2	2	2	16x8
3	2	2	16x10
4	2	2	18x10
6	2	2	20x12

2.11 FIN ENCLOSURE

A. For all exposed horizontal piping on a wall that is below 4ft, provide Sterling PCH-17 horizontal pipe enclosure, no louvers, flat top. Enclosure to be 18 CRS, 17" in height. Color selection by Architect.

PART 3 - EXECUTION

3.01 GENERAL PIPE INSTALLATION

A. The following shall describe methods of assembly to be followed in the installations of piping by the Contractor:

1. All pipe shall be clean and free of internal mill scale, dirt, etc. before installation.

2. All pipe shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing except where specifically called for. All pipe shall be out of the way of all windows, doors and other building openings or structural parts. All pipe shall be so installed that it can expand and contract freely without damage to any other portions of the work or to itself. All pipe, after having been cut, shall be reamed so as to present full pipe size. All changes in direction shall be made with proper pipe fittings. All pipe shall be installed approximately as indicated upon the plans and as specified. Piping connections to pieces of equipment shall be in accordance with the details shown on the plans or as specified. All open ends of pipe or equipment shall be properly capped or plugged during the installation in order to keep dirt and foreign matter out of the system.

3. Run-outs and branches from mains to units above the mains shall be taken from the top of the main and sloped up to the units. Run-outs and/or branches for heating units below the mains shall be taken from the bottom of the main and sloped down to the units, except where specifically noted.

4. All changes in supply main size shall be made with eccentric fittings arranged so as not to pocket entrained air.

5. All changes in directions of pipe lines shall be made with proper welding fittings for welded pipe and proper screwed joint fittings for screwed pipe and proper soldering fittings for soldered or brazed tube connections.

3.02 EQUIPMENT AND SYSTEMS

A. Dissimilar metals shall not be in contact with each other (i.e. steel and copper shall never touch). Provide dielectric fittings between dissimilar metals. Brass between dissimilar metals shall only be used under engineers written approval.

B. All equipment and systems as shown on the drawings or specified herein shall be installed in accordance with the provisions of each applicable section of these specifications and all local and state codes and regulations having jurisdiction.

C. All installations shall be performed in a workmanlike manner as determined by the Architects or Owner.

D. Accurately establish grade and elevation of all piping before setting sleeves. Arrange piping at equipment with necessary offsets, unions, flanges, valves, to allow for each part removal and maintenance, as approved.

E. Offset piping and change elevation as required to coordinate with all other trades.

F. Avoid contact with any part of other mechanical or electrical systems.

G. Provide adequate means of draining and venting all units, risers, circuits and systems.

H. Conceal all piping unless otherwise specified.

I. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation.

J. Provide trap seal of adequate depth in overflow line on each drain pan installation.

K. All cleanout plugs, bushings and nipples, required for gauge and instrument installation shall be brass.

L. Do not install valves, unions and flanges in inaccessible locations.

M. Materials used within a system and between systems shall be consistent. If this is not possible, install approved dielectric fittings.

N. Ream pipes after cutting and clean before installing.

O. Refer to Specification Section 232100 - Water Systems Specialties & Equipment; for water system fill requirements.

3.03 FABRICATION AND CONNECTIONS

A. Area of interior welding/soldering shall be ventilated. Personnel shall use respirator protection in accordance with OSHA if ventilation cannot be accomplished during welding/soldering operations in the field.

B. Fabrication methods as specified in Pipe & Fittings Products, shall be as follows:

C. Welding:

1. Contractor shall provide welders who are qualified to Section IX of the ASME Boiler and Pressure Vessel Code.

2. All welds shall conform and be inspected in accordance with ASME B31.9 pressure piping.

3. Comply, with Section II, Part C. ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

4. Welding can be electric arc or oxy-acetylene and shall present a complete fusion of the weld metal and parent metals for the full depth and/or thickness of adjacent butted parent metals and for the complete circumference.

5. Weld and fabrication sequence shall be arranged to avoid distortion or damage to piping and fittings. Cutting of pipe shall be done to achieve straight lines and squared surfaces.

D. Flanged Connections:

1. Flanged joints shall be carefully aligned and flange bolts, nuts and fastener bearing surfaces shall be lubricated with a heavy graphite oil mixture.

2. Initial tightening of flange bolts shall be 1/2 of the final torque and shall be tightened in a proper sequence pattern. Final tightening shall be uniform with each bolt pulling the same load. Bolts shall be re-tightened 24 hours after final tightening. Torque values shall be in accordance with industrial standards.

3. Furnish gasket material, thickness and type suitable for fluid to be handled, and design temperatures and pressures.

E. Soft Solder Joints - 95/5: Thoroughly clean, apply flux, heat mating parts and apply solder to flow over and form a complete bond of mating parts. Remove excess solder and hold each joint rigid and still until completely cooled. Soft solder shall be 95% tin - 5% antimony, Mueller Brass Co., #95; or equal. Bring soldering flux on job in 2 oz. cans only and keep sealed when not in use.

F. Screw Joints: Shall be made with standard taper pipe threads, properly cut and made up with "permatex", or equal, pipe dope applied to male ends. The use of teflon type tape shall not be permitted.

G. Grooved Connections: Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. A Victaulic factory trained representative (direct employee) shall provide on-site training for contractor’s field personnel in the use of grooving tools, application of groove, and product installation. All groove depths shall be checked manually or by grooving tool (RG5200i). A Victaulic representative shall periodically visit the job site and review installation.

H. Mechanical Press Fittings: Pipe ends shall be cut on a right angle (square) to the tube. Pipe ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the tube end with a clean rag. Visually examine the fitting sealing element to ensure there is no damage, and it is properly seated into the fitting. Insert tube fully into the fitting. Make a mark with a felt tip pen on the pipe at the face of the fitting. Always examine the tube to insure it is fully inserted into the fitting prior to pressing the joint. Utilize manufacturer’s

recommended tool(s) to make final connection. Sealing elements shall be verified for the intended use. Installers shall attend manufacturer's installation training class prior to start of work.

3.04 TESTING

A. Preparation and testing shall be in accordance with ASME B31.9.

B. Refer to Specification Section 230593 - Testing, Adjusting and Balancing; for adjusting and balancing of systems.

C. Preparation:

1. Leave joints including welds uninsulated and exposed for examination during the test.

2. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.

4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of over-pressure during the test.

D. Hydrostatic Testing (Hydronic Systems):

1. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.

2. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the liquid.

3. Examine system to see that equipment and components that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.

4. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 100 psi or 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve or other component in the system under test. Make a check to verify the stress due to pressure at the bottom of vertical runs does not exceed either 90% of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, Building Services Piping.

5. After the hydrostatic test pressure has been applied for at least 2 hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing or replacing components as appropriate and repeat hydrostatic test until there are no leaks.

6. Clean and flush hydronic piping systems. Remove, clean and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.

E. Pressure Testing and Inspection - General:

1. Prior to acceptance and initial operation, all piping installations shall be inspected and tested to determine that the materials, design, fabrication and installation practices comply with Code Requirements.

2. Inspection shall consist of visual examination, during or after manufacture, fabrication, assembly or pressure tests as appropriate. Supplementary types of non-destructive inspection techniques, such as magnetic-particle, radiographic, ultrasonic, etc. shall not be required unless specifically listed herein or in the engineering design.

3. In the event repairs or additions are made following pressure test, the affected piping shall be tested, except that, in the case of minor repairs or additions, testing shall be permitted to be omitted where precautionary measures are taken to ensure sound construction.

4. Because it is sometimes necessary to divide a piping system into test sections and install test heads, connecting piping and other necessary appurtenances for testing, it is not required that the tie-in sections of pipe be pressure tested. Tie-in connections, however, shall be tested with soap solution after gas has been introduced and the pressure has been increased sufficiently to give some indications should leaks exist.

F. Test Preparation:

1. Pipe joints, including welds, shall be left exposed for examination during the test. If the pipe end joints have been previously tested in accordance with Code Requirements, they shall be permitted to be covered or concealed.

2. Equipment that is not to be included in the test shall be either disconnected from the piping or isolated by blanks, blind flanges, or caps. Flanged joints at which blinds are inserted to blank off other equipment during the test shall not be required to be tested.

3. Where the piping system is connected to equipment or components designed for operating pressures of less than the test pressure, such equipment or equipment components shall be isolated from the piping system by disconnecting them and capping the outlet(s).

G. Test Pressure:

1. Test pressure shall be measured with a manometer or with a pressure measuring device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made.

2. The test pressure to be used shall be no less than 1-1/2 times the proposed maximum working pressure, but not less than 3 psig (20 kPa gauge), irrespective of design pressure. Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

3. Test duration shall be not less than 1/2 hour for each 500 cubic feet of pipe volume or fraction thereof. When testing a system having a volume less than 10 cubic feet, the test duration shall be permitted to be reduced to 10 minutes. For piping systems having a volume of more than 24,000 cubic feet, the duration of the test shall not be required to exceed 24 hours.

H. Detection of Leaks and Defects:

1. The piping system shall withstand the test pressure specified without showing any evidence of leakage or other defects. Any reduction of test pressures as indicated by pressure gauges shall be deemed to indicate the presence of a leak unless such reduction can be readily attributed to some other cause.

2. The leakage shall be located by means of an approved combustible gas detector, soap and water, or an equivalent non-flammable solution. Matches, candles, open flames, or other methods that could provide a source of ignition shall not be used.

3. CAUTION: Since some leak test solutions, including soap and water, may cause corrosion or stress cracking, the piping shall be rinsed with water after testing, unless it has been determined the leak test solution is non-corrosive.

4. Where leakage or other defects are located, the affected portion of the piping system shall be repaired or replaced and re-tested.

I. Test Records: Records shall be made of inspection and all tests performed. These records shall indicate which portions of the piping system conform to Code Requirements or were pressure tested.

3.05 FILLING & FLUSHING – FOR SMALL RENOVATIONS

A. Refer to specification 232115 for large scale renovations if required. This section is intended for areas of work only.

B. Isolate system from existing.

C. Fill system and properly vent.

D. Hydrostatically test the system to check for leaks and fix any leaks as soon as discovered.

E. Start pumps to circulate water through system.

F. Blow down strainers on new equipment and clean as needed.

G. Vent all units as required.

H. Make necessary connections of new piping to existing.

I. Contractor shall be responsible to fill any glycol lost in the connection process.

J. Vent new and existing systems as required. Some existing systems may have been affected with draining for the new work.

K. Hydrostatically test new systems and insure that any discovered leaks will be repaired. Special attention is required to ensure that there is no leakage from valves, AV's or other equipment. Contractor shall be responsible for replacing ceilings or other surfaces damaged by leaks from new work.

L. If Contractor discovers severely degraded piping near areas of work, he shall immediately notify the Architect, in writing.

M. Provide written report to Architect stating the completion of above procedure and dates of completion.

END OF SECTION

SECTION 232300 - REFRIGERATION PIPING & SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this section.

1.02 SUBMITTALS

A. Product data for all piping and specialties.

1.03 REFERENCE STANDARDS AND CODES

A. All installations and materials shall conform to applicable 2020 New York State Building Code, and local building and plumbing codes.

B. All piping shall be inspected and approved by Underwriters Laboratories and bear the UL label.

C. All installations shall conform to requirements of Owner's Insurance carriers.

D. Refer to the latest edition and applicable sections of the following:

1. American Society of Testing and Materials (ASTM)

2. American National Standards Institute (ANSI)

3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

4. Piping shall conform to ASHRAE 15 Standards.

5. American Welding Society (AWS).

6. American Refrigerant Institute (ARI).

7. Underwriters Laboratories (UL).

8. American Society of Mechanical Engineers (ASME), Code for Pressure Piping B31.5 - Refrigerant Piping.

1.04 GENERAL REQUIREMENTS

A. All materials furnished and all installations made under this specification shall conform with the applicable requirements of the codes and standards described herein.

B. Layout of equipment, piping, etc. is diagrammatic, unless detailed. Check project drawings prior to making installations for interference's with other trades and services. Owner reserves the right to make reasonable changes prior to "rough-in" without added expense. All dimensions shown are subject to verification of exact site conditions.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Refrigerant Piping (7/8" & Below): Type K, seamless soft temper ACR copper tubing coils, ASTM B-280, factory cleaned with ends capped; flare type threaded fittings, flared tube ends.

B. Refrigerant Piping (1" & Above): Type L, seamless hard temper ACR copper tube, ASTM B-88; wrought copper socket fittings, ANSI B16.22; silver brazing joints, with minimum 3 CFM nitrogen purge.

2.02 REFRIGERATION SPECIALTIES

A. Refrigerant piping specialties shall be UL listed and designed to conform to ARI Standard 760.

B. MF-1: Flexible connector for refrigerant service, size as indicated on drawings, suitable for use on ACR tubing, corrugated phosphorus bronze tube, bronze braid, braid sleeves, end fittings shall be copper female solder type. Unit shall be cleaned and dried for refrigerant service and shipped sealed. Furnish compressor connector, Flexonics Co.; or equal.

C. RSS-1: Refrigerant pipeline strainer; 500 psig maximum working pressure; forged brass body with monel 80-mesh screen and screwed cleanout plug; Y-pattern, with solder end connections.

D. Sight Glass: (Moisture/liquid indicators); 500 psig maximum operation pressure, 200°F maximum operation temperature; forged brass body, with replaceable polished optical viewing window and solder end connections.

E. Filter Dryer: 500 psig maximum operation pressure; steel shell, flange ring and spring, ductile iron cover plate with steel cap-screws and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-dryer core kit of standard capacity desiccant sieves to provide micronic filtration, including gaskets.

F. LLS: Liquid line solenoid valve; 250°F temperature rating, 400 psig working pressure, forged brass , with Teflon valve seat, two-way straight through pattern and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2" conduit adapter, and 24 Volt, 60 Hertz normally closed holding coil.

G. TXV: Thermal expansion valves; thermostatic adjustable, modulating type; size as required for specific evaporator requirements and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line and an external equalizer line.

H. HGBV: Hot gas bypass valve; adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading and wrought copper fittings for solder end connections.

I. EPRV: Evaporator pressure regulating valves; pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gauge tappings, 24 Volts DC, 50/60 Hertz, standard coil and wrought copper fittings for solder end connections.

2.03 LIABILITY

A. Contractor shall be held liable throughout guarantee period for any damage from failure of piping and accessories due to poor or faulty workmanship and/or defective materials.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all specialties in accordance with requirements for refrigerant piping as recommended by the condenser manufacturer. Refer to Specifications Sections 238115 - Air Cooled Condensing Units and 238110 - Packaged Air Conditioning Units.

B. Refer to Specification section 232113 - Piping Systems and Accessories; for pipe identification, nameplates, hangers and general pipe installation.

3.02 FABRICATION

A. Area of interior brazing shall be ventilated. Personnel shall use respirator protection in accordance with OSHA standards if ventilation cannot be accomplished during operations in the field.

B. Silver Alloy Brazed Joints - in accordance with AWS A5.8, Class BAg1, shall be prepared and made up in complete conformity with the instructions of the brazing alloy and flux manufacturer and shall include complete and thorough cleaning of the mating parts after which an even coating of flux shall be applied to the mating parts. The mating shall be assembled, held rigid and heat applied evenly by oxy-acetylene torch to the complete areas to be joined after which silver alloy shall be flowed into the joint. Silver brazing alloy flux shall be low silver content (15%), melting at 1185°F and free flowing at 1300°F, suitable for joints between copper, brass and bronze. Silver brazing alloy flux shall be specifically for low temperature silver brazing alloy, free flowing at 1100°F. Silver brazing alloy flux shall be Handy & Harman, "Handy-Flux"; or an approved equal. Silver brazing alloy flux shall be brought on the job in only one pound containers and shall be kept sealed when not in use. Silver brazing alloy shall be Handy & Harman, "Sil-Fos"; or an approved equal.

3.03 TESTING AND SYSTEM FILLING

A. Examine rough-in for refrigeration piping systems to verify actual locations of piping connections prior to installation.

B. Install piping free of sags or bends with ample space between piping to permit proper insulation applications.

C. Inspect, test and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter IV.

D. Repair leaking joints using new materials and retest for leaks.

E. Charge system using the following procedures:

1. Install core in filter dryer after leak test but before evacuation.
2. Evacuate refrigeration system with vacuum pump; until temperature of 35°F is indicated on vacuum dehydration indicator.
3. During evacuation apply heat to pockets, elbows and low spots in piping.
4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
5. Break vacuum with refrigeration gas, allow pressure to build up to 2 psi.
6. Complete charging of system using new filter dryer core in charging line. Provide full operating charge.

END OF SECTION

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including the General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this section.

1.02 SUBMITTALS

A. Schedule of all components.

B. Product data sheets on all equipment.

C. Submit shop drawings on all equipment. Include all performance and dimensional data.

1.03 GENERAL REQUIREMENTS

A. All control dampers shall have published performance data taken from test made in accordance with AMCA Standard 500 and in compliance with the AMCA certified ratings program for air performance and air leakage performance.

B. All fire dampers shall be rated for 1-1/2 hrs (unless specifically noted otherwise) under UL Standard 555 and shall meet NFPA 90A construction requirements.

C. Backdraft dampers shall have performance data published under the guidelines of AMCA and conform to all safety standards as set forth by NFPA 90A.

PART 2 - PRODUCTS

2.01 VOLUME DAMPERS

A. Provide where indicated on drawings or required to control air flow, for air balancing, size as required, manually operated.

B. For Rectangular Ducts up to 12" Max Dimension: Single blade volume damper for use by air balancing contractor. Damper may be fabricated by sheetmetal contractor. Damper blade shall be fabricated from stiff material and be free from operating noise. Ensure sufficient clearance between damper blade and duct wall to prevent noise. Provide external position indication and locking quadrant.

C. For Rectangular Ducts Over 12": Furnish and install where indicated on drawings, size as required, manually operated, opposed blade damper, 16 ga. galvanized steel construction, concealed linkage, with manual locking quadrant. Model #VCD-20, Greenheck Fan Corporation; or equal.

D. For Round Ducts: When volume damper is not an integral part of branch connection, furnish and install where indicated, size as required, manually operated, round air balancing damper, galvanized steel construction with manual locking quadrant. Model VCDR-53, Greenheck Fan Corporation.

E. BD-1: Backdraft damper, nonmetallic type with blades constructed of neoprene coated fiberglass. Extruded aluminum channel. Model #BD51, Pottorff Mfg.; or an approved equal. Don’t have a vinyl blade damper.

F. BD-2: Counter balanced backdraft damper, constructed of 75 aluminum blades with neoprene blade seal and steel axles will ride on ball bearing. Model #EM-30, Greenheck Fan Corporation.

G. OBVD-1: Opposed Blade Volume Damper, aluminum construction, parallel blade, Oilite Bronze bearings, Stainless steel jamb seals and vinyl blade seals, stainless steel linkage. Model #VCD-43, Greenheck Fan Corporation.

2.02 FIRE DAMPERS

A. FRD-A: Fire dampers used in transfer air sleeves between adjacent rooms above ceilings, UL listed 1-1/2 hour rating. Nailor Industries Model #0110 or equal.

B. FRD-B: Fire dampers shall be manufactured, tested and labeled in accordance with UL 555 Safety Standard for Fire Dampers - Sixth Edition, June 1999, and shall have 1-1/2 hour fire resistance rating. Each fire damper shall bear a UL label verifying fire resistance rating in addition to intended mounting position. Fire dampers shall be suitably constructed for vertical or horizontal installation as required for each specific location. Each fire damper shall be complete with a 165°F (74°C) UL Listed fusible link. Fire dampers shall each include a steel sleeve of appropriate length/gauge and retaining angles, supplied by damper manufacturer to ensure proper installation in accordance with damper manufacturer's instructions. Damper to have blades out of air steam. Contractor shall provide and install an access door at each fire damper, of appropriate size to allow for inspection, testing and fusible link replacement. Information submitted for approval shall include confirmation of UL qualifications, pressure drop data and manufacturer's installation instructions. Fire dampers shall be Nailor Industries Models 0120 (Type B), or equal. Use Model 0130V or 0130H for round ducts.

C. FRD-S: Provide fire/smoke dampers where indicated on drawings. UL 555S classified Class II leakage rating at 250 degrees and UL 555 listed 1-1/2 hour labeled. Nailor Model # 1270ERL with min. 16" long 20 gauge sleeve and 120 volt electric actuator, with actuator out of airstream, and 165ºF heat responsive device. Contractor shall provide and install an access door at each fire damper, of appropriate size to allow for inspection and testing. Electrical contractor shall furnish smoke detector to heating contractor – heating contractor to install within 5'-0" of damper. Install detector per manufacturer's recommendations and requirements.

2.03 DUCT ACCESS DOORS

A. Furnish and install where indicated on plans and/or required for access to life safety dampers, control probes, etc.; galvanized door with manual lock(s), double wall, 1" internal fiberglass insulation, galvanized steel frame, foam gasket seal, minimum 24 gauge construction. Label each access door at fire dampers with "Fire Damper" in letters no less than 1/2" high.

1. Hinged Type: Model #H-10, Buckley Air Products
2. Double Latch Type: Model #C-10, Buckley Air Products

2.04 ARCHITECTURAL ACCESS DOORS

A. Ceiling/Wall Access Door: door and frame for use in existing ceiling or walls. Door and frame fabricated from galvanized steel, thickness as scheduled, with rounded edges and concealed pivoting rod hinge. Frame shall be one piece construction with no miters or welds exposed on face. Door shall include screw driver type latch mechanism.

B. For Existing Ceilings: Provide concealed 1-1/2"x 1-1/2" support angles to be used as a sub-structure to support door frame above existing ceiling.

C. For Fire Rated Doors: Doors shall be UL Listed for fire rated service as scheduled. Door shall include heavy duty spring closer.

Tag	**AD**	**ADF**
Model #	BNTC 24x24	BIT 24x24
Manufacturer	Babcock-Davis	
Fire Rating (hours)	None	1.5
Fire Rating Label	None	B
Steel Thickness	16 gauge	16 gauge
Size (inches)	24x24	24x24
Weight (lbs)	16	24.5
Latches (Qty)	3	1
Notes	(1)(2)	(1)(2)

Notes:
(1) Finish factory prime coat, contractor shall field paint white to match ceiling where located.
(2) Contractor shall verify actual size prior to ordering if required to fit actual ceiling tile arrangement, size may be adjusted to 22x22. However, no gaps are to be allowed from door frame flange and adjacent existing ceiling tiles around perimeter.

2.05 CODE REQUIREMENTS

A. All work shall be in accordance with all applicable codes including NFPA 90A, 90B, and SMACNA requirements.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all equipment in strict accordance with manufacturer's instructions.

3.02 DAMPERS

A. Contractor to furnish all required hardware to complete installation of air split damper and regulator.

B. Provide access doors for dampers not accessible from grilles.

C. Dampers shall be installed so as not to cause stress or strain on the frames. Fasteners shall not interfere with proper operation of blades or linkages.

D. Lubricate and thoroughly clean all moving parts according to the manufacturer's recommendations before initial operation.

E. Seal all seams.

F. Make all necessary adjustments to linkages to insure dampers open fully and close tightly over full stroke of actuator.

G. Replace any damaged parts including blades, seals, linkages, etc.

H. Install automatic vent damper in strict accordance with manufacturer's instructions and NFPA 54.

END OF SECTION

SECTION 233310 - DUCTWORK HANGERS & SUPPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to work of this section.

1.02 SUBMITTALS

A. See Section 233330 for submittal requirements.

1.03 WORK INCLUDED

A. Contractor shall provide all hangers and supports for all ductwork and air system equipment and accessories.

B. Contractor shall field verify and coordinate all ductwork hangers and supports, dimensions, clearances, and ductwork elevations with new and existing building structure.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Section 233330 - Low Velocity Ductwork

B. Section 230713 - Duct Insulation

1.05 QUALITY ASSURANCE

A. SMACNA Manual: Methods of supporting ductwork shall be in accordance with the SMACNA Manual, Section 1 - Low Velocity Systems", unless otherwise shown on the drawings or specified herein.

B. SMACNA - Sheetmetal and Air Conditioning Contractors National Association, Inc.

C. Electrically operated and power actuated tools for installing welded studs and power driven fasteners shall be listed by a nationally recognized test agency.

PART 2 - PRODUCTS

2.01 DUCT HANGERS

A. All Hangers Shall Be Rod Type Hangers: Mild carbon steel, unless otherwise specified; fully threaded or threaded each end, with (2) removable nuts each end for positioning and locking rod in place. Unless galvanized or cadmium plated, provide a shop coat of red lead or zinc chromate primer paint.

B. Hangers for ducts shall be as specified in the SMACNA Manual, with the following exceptions:

1. Lower hanger attachments for rectangular duct with any dimension 18" and above shall be trapeze hangers, supported by threaded rods (3/8" dia. min.).

2. Trapeze hangers shall be minimum 1-1/2" x 1-1/2" x 1/4" angle or larger size as required by larger or heavier ductwork. Ductmate trapeze hanger size AS and AT is acceptable.

3. Lower hanger attachments for rectangular duct with maximum dimension less than 18" may be flat strap attached directly to duct. Fasteners penetrating ducts must be completely sealed.

4. Wire used as supports or as banding shall not be acceptable.

5. Fasteners used on hanger system shall not penetrate supported ductwork. (Exception: Flat strap hangers, see above.)

6. Threaded support rods shall utilize sufficient support, jamb, and lock nuts to allow adjustment of duct heights.

2.02 MISCELLANEOUS FASTENERS AND UPPER HANGER ATTACHMENTS

A. Machine Bolts and Nuts: Galvanized or cadmium plated steel.

B. Steel "C" Clamp with Locknut: Elcen Co.; No. 29L, with 25B steel retaining clips.

C. Structural Aluminum Shapes and Aluminum Plates.

D. Structural Steel Shapes and Steel Plates: ASTM A-36, shop primed.

E. Self Drilling Expanding Fasteners: Phillips type.

2.03 BRANCH FITTINGS, JOINTS & TURNING VANES

A. Provide supports necessary for lengths over 16" or heights over 8".

PART 3 - EXECUTION

3.01 UPPER HANGER ATTACHMENTS

A. General Notes: Upper hanger attachments for ductwork shall be secured to overhead structural steel or steel bar joists wherever possible, unless otherwise specified.

B. In addition, when required by ductwork support spacing schedules, provide intermediate structural steel members, framed to span the structural steel or steel bar joists. The minimum size of structural steel members, for use as intermediate steel framing, shall be 2-1/2" x 2-1/2" x 1/4" steel angles. Intermediate steel members shall be shop prime coated prior to installation. Intermediate steel will be sized for span and load to show no deflection.

C. Secure upper hanger attachments to bar joists at the panel points of joists.

D. Do not drill holes in main structural steel members.

E. Exercise extreme care in the field drilling of holes in precast or pre-stressed concrete work, so as to avoid damage to reinforcing. Power driven types of fastening devices shall have be utilized in the attachment of hangers to precast or pre-stressed concrete work.

F. Upper hanger attachments shall be as specified in the Manual, with the following exceptions:

1. Do not use flat bar, bent rod, power actuated drive pins or expansion nails as upper hanger attachments in concrete construction.

G. Attachment to Structural Steel: Secure to steel beams with beam clamps, welded studs, power actuated fasteners, or "C" clamps with lock nuts and minimum 1/8"x1" wide safety bars.

H. Do not use power actuated fasteners except by written permission from the Engineer's Representative.

I. Do not attach welded studs or powder actuated fasteners to steel less than 3/16" in thickness.

J. Do not use power drive on beam clamps.

K. Attachment to New Poured Concrete Construction: Support hangers from concrete insets. Properly locate and install concrete inserts in concrete form work as required, in ample time so as not to delay the construction work. Bolt band iron hangers to inserts with 3/8" bolts. Screw rods into proper size inserts and secure with lock nuts and washers.

L. Attachment to Cellular Steel or Fluted Metal Decks: Do not support ductwork from cellular steel or fluted metal roof decks. Attach hangers to structural steel members wherever possible, and where required intermediate structural steel supporting members shall be provided, framed to span the structural steel.

M. For attachment to overhead cellular steel or fluted metal decking, other than roof decks, hangers may be attached by means of welded studs with double nuts. The maximum load on any one stud shall be 250 lbs**. UNDER NO CIRCUMSTANCES SHALL UPPER ATTACHMENTS PENETRATE STEEL DECKING, OR ROOF DECK.**

N. Riser Supports: Support vertical rectangular ducts by means of two steel angles or channels, anchor bolted to floor slab or adjacent structural member at every floor through which the riser passes. Steel angles or channels shall contact a transverse joint and be secured to the joints by means of 1/8" bolts, or by welding.

O. Steel angle or channel support sizes shall be as follows:

Max. Side Dimension	Support Angle	Support Channel	Bear on Concrete or Structural Support
36"	1"x1"x1/8"	1"x1/2"x1/8"	2"
48"	1-1/2"x1-1/2"x1/8"	1-1/2"x3/4"x1/8"	3"
60"	2"x2"x1/8"	2"x1"x1/8"	3"
Over 60"	2-1/2"x2-1/2"x3/16"	2"x1"x3/16"	4"

3.02 DUCT HANGER SPACING

A. The duct hanging method must be in accordance with this specification and is subject to Engineer's approval.

B. Duct hanger spacing shall be in strict accordance with SMACNA and as follows:

1. Rectangular Duct Hangers Min. Sizes:

Max. Half of Duct Perimeter	Rod Pair at 10'Spacing	Rod Pair at 8'Spacing	Rod Pair at 6'Spacing	Rod Pair at 4'Spacing
Up to 72	1/4"	1/4"	1/4"	1/4"
73 to 96	3/8"	1/4"	1/4"	1/4"
97 to 120	3/8"	3/8"	1/4"	1/4"
121 to 168	1/2"	3/8"	3/8"	3/8"
169 to 192	1/2"	1/2"	3/8"	3/8"
Above	SEE SMACNA FOR SPECIAL CONDITIONS			

2. Round Duct Hanger Strap Sizes:

Duct Diameter	Strap Hangers	Max. Spacing
Up to 26"	One 1" x 22 Ga.	12 Ft.
27" - 36"	One 1" x 18 Ga.	12 Ft.
37" - 50"	One 1" x 16 Ga.	12 Ft.
51" - 60"	Two 1" x 18 Ga.	12 Ft.

See SMACNA, Table 5-3 for allowable loading for trapeze angles.

END OF SECTION

SECTION 233330 - LOW VELOCITY DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work of this section.

1.02 SUBMITTAL

A. Layouts of duct systems shown on contract drawings are diagrammatic. Actual duct layout and fabrication shop drawings are required to be submitted for approval. Coordinate these shop drawings with other trades and existing conditions, as required for proper installation, prior to submittal.

B. Please note that ductwork CAD files will not be given to the contractor. Contractor is expected to field verify and draw all ductwork.

C. General duct layout, 3/8" = 1'-0" scale, of all duct systems, including dimensions and elevations.

D. Ductwork shop drawings shall be fabrication drawings, showing actual intended location of ductwork and clearances. Ductwork elevations and architect's ceiling heights shall be noted on drawings.

E. All areas where ductwork is below the architect's ceiling height shall be noted and clouded. **FAILURE TO NOTE BOTH BOTTOM OF DUCT ELEVATIONS AND ARCHITECT'S CEILING HEIGHTS WILL BE CAUSE FOR REJECTION.**

F. Duct shop drawings shall show actual existing and/or new structural steel arrangements, and shall be coordinated to properly fit in intended spaces.

G. Sheetmetal contractor shall verify that ductwork layouts are coordinated with all other construction trades which might cause a conflict. This contractor is required to provide copies of duct shop drawings to all applicable contractors for their use in coordination efforts.

H. Immediately notify Engineer if a duct layout conflict is discovered.

I. Submittal packages which do not include all items listed in this section will be considered incomplete and will be returned to the contractor without review.

J. If a significant number of shop drawings are required, individual drawings may be submitted for review. Duct construction booklet must accompany initial submittal or it will be considered incomplete and returned without review.

K. Fabrication of installation of ductwork shall not be permitted unless duct shop drawings and construction booklet are approved by Engineer.

L. Contractor will be required to remove ductwork installed without duct submittals conforming to requirements of this section and approved by the Engineer.

1.03 DUCT CONSTRUCTION BOOKLET

A. Duct construction booklet shall be submitted with initial duct layout drawing submittal.

B. The following is a basic list of materials, devices, methods, etc. that shall be described in the ductwork construction booklet submittal:

1. Manufacturer's data sheets for all purchased duct accessory components (damper hardware, duct liner, access doors, etc.)
2. Gauges of ductwork, material, method of construction, types of reinforcing and joints, etc.
3. Transverse and Longitudinal Joints
4. Duct Fitting Construction
5. Duct Sealing & Sealants
6. Duct Hangers, Type, Spacing, Upper, Lower
7. Special Supply Air Duct Construction Details (i.e. 14 gauge)
8. Branch Duct Connections Details
9. Acoustic Lining
10. Flexible Ductwork
11. Flexible Connection (to AHU's etc.)
12. Access Doors
13. Duct Accessories
14. Volume Dampers
15. Locking Quadrants
16. Remote Control Damper Regulators
17. Turning Vanes
18. Penetration Trim Frames
19. Fire Damper Installation Details
20. Fire Proofing Penetrations, Chase Safing
21. Specialty Duct Construction and Installation Methods
22. Other Specialty Equipment Connections

1.04 RELATED SUBMITTALS

A. The following shop drawings are required under other specification sections and must be submitted as separate packages (in addition to ductwork submittals detailed in this section).

1. Exhaust Fans
2. Louvers
3. Roof Hoods
4. Diffusers, Registers, Grilles
5. Ductwork Accessories:
   a) Special volume control dampers
   b) Fire and/or smoke dampers
   c) Remote control damper actuators

1.05 WORK REQUIRED

A. Contractor shall furnish materials and labor and shall fabricate and erect all sheetmetal ductwork including connections to units, all dampers, registers, diffusers and accessories as shown on the drawings, described herein and/or as required to make the air handling installations complete.

B. Complete supply and return air ductwork serving all units.

C. All exhaust air ductwork.

D. Relief air ductwork.

E. Ductwork and connection into existing air systems where applicable in existing building.

F. Installation of all intakes and discharges including exhaust fans, louvers, roof hoods.

G. Specialty ductwork and specialty equipment for applicable kitchen, fume exhaust, safety hoods, and other specialty systems where indicated.

H. Modification of existing air system equipment to meet new air system requirements (i.e. - fan drives, belts, sheaves, fan motors, etc.).

I. Complete balancing of all air systems.

J. Contractor shall field verify and coordinate all ductwork, dimensions, clearances, and ductwork elevations with existing building structure.

1.06 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230005 - MECHANICAL Work General
B. Section 230593 - Testing, Adjusting & Balancing
C. Section 230713 - Ductwork Insulation
D. Section 233300 - Ductwork Accessories
E. Section 233310 - Ductwork Hangers & Supports

1.07 QUALITY ASSURANCE

A. SMACNA Manual: Gauges of materials, fabrication and installation of ductwork shall be in accordance with the SMACNA Manual, Section 1 - "Low Velocity Systems", unless otherwise shown on the drawings or specified herein.

B. SMACNA - Sheetmetal and Air Conditioning Contractors National Association, Inc.

C. New York State Energy Code.

D. 2020 New York State Building Code.

E. Electrically operated and power actuated tools for installing welded studs and power driven fasteners shall be listed by a nationally recognized test agency.

1.08 PRODUCT HANDLING

A. Protection: Use all means necessary to protect materials of this Section before, during and after installation and to protect installed 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 Engineer and at no additional cost to the Owner.

C. Delivery and storage: Deliver all materials to the jobsite in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations.

D. Ductwork that is shop fabricated shall be delivered to the site in quantities acceptable to the storage area that the General Contractor has available.

PART 2 - PRODUCTS

2.01 GENERAL

A. For the purpose of establishing equality, certain manufacturers have been specified herein. In no way shall this be construed as limiting competition. Products of other manufacturer's may be proposed in accordance with the provisions of the Contract.

B. Fabrication: All ducts, unless otherwise allowed, shall be true to dimensions indicated upon plans, straight and smooth on inside, with neatly finished joints. Securely anchor to building construction in acceptable manner, free from vibration under all conditions of operation, and properly brace and reinforce with aluminum angle or other structural members. Slip joints shall be in direction of flow. Elbows shall have centerline radius equal to 1-1/2 times width of duct.

C. All ductwork with a 4 to 1 ratio, and higher shall have a Condu-lock internal reinforcing at midpoint between joints, both horizontally and vertically.

D. All ductwork 10 ft downstream of a VAV to be internally lined, whether shown or not.

2.02 SHEETMETAL

A. Galvanized Steel: ASTM A653/A653M lock forming quality – zinc-coated (galvanized): ASTM A653/A653M commercial coating class – 0.9 oz. per sq. ft.

B. 2" W.G. Low Pressure Rectangular Duct Construction:
1. Note: These gauges are 1 gauge heavier than required by SMACNA.

Longest Side	Gauge	SMACNA Rigid Class (1)	Stiffeners Spacing
0-12"	24	A	5'
13-30"	22	B	5'
31-54"	20	B	5'
55-84"	18	E	5'

C. 2" W.G. Low Pressure Round Duct Construction:

Diameter	Gauge
0-12"	26
13-24"	24
25-36	22

D. Aluminum Ductwork: Use 1 gauge heavier than required by SMACNA Standards.

2.03 LONGITUDINAL JOINTS FOR RECTANGULAR DUCT

A. Seams shall be formed and assembled with proper dimensions for tight and secure fit. Notching shall be minimal consistent with transverse joint requirements.

B. Standard longitudinal seam shall be Pittsburgh Lock Standing seams are not acceptable.

2.04 TRANSVERSE JOINTS FOR RECTANGULAR DUCT

A. Joint type shall be selected on the basis of ± 2" wg. Pressure class, materials, support intervals, and other provisions for proper assembly of ductwork.

B. All transverse joints with any dimension greater than 16" shall be constructed with the Duct Mate system; or an approved equal. All transverse joints 16" and less shall be slip and drive.

C. Contractor shall submit for approval the intended joint type with the duct construction detail book submittal.

D. Turning Vanes and Vane Runners: Weld runners to duct and weld vanes to runners, all as shown on the drawings. All turning vanes shall be air foil type.

2.05 DUCTWORK FITTINGS

A. All elbows on main supply ducts shall be radiused type fittings.

B. Where square elbows are allowed, turning vanes shall be used. Square fittings without turning vanes are not permitted.

2.06 BRANCH CONNECTIONS

A. Furnish and install where indicated on drawings, size as required, the following:

1. For rectangular branch ducts: 45 degree cinch collar, each branch duct to include a volume damper.

2. For round duct branches: High efficiency take-off type fitting with integral volume damper.

3. Branch duct connections regardless of size or type will be fully sealed by an approved method.

2.07 ROUND DUCT CONSTRUCTION

A. Round duct seams shall be spiral lockseam type. Snap lock or lap seams are not acceptable. Duct and fittings shall be single wall Uni-Seal Duct, United McGill Corp.; or equal, unless noted otherwise.

2.08 DUCT SEALING REQUIREMENTS

A. All ductwork, fittings, connections to equipment, damper connections, branch duct connections, and other duct system joints shall be sealed in accordance with the duct system sealing schedule.

B. The term sealed requires the use of liquids, mastics, combination mastics and open weave fabric, gaskets, or other sealing compounds made exclusively for duct work applications. Oil base caulking and glazing compounds shall not be used.

C. Tapes shall not be applied to metal surfaces or to dry sealant.

D. Liquid: As recommended by the manufacturer of the ductwork.

E. Mastic: 3M Co. #ED-800 or 900.

F. Gaskets: Soft neoprene or reinforced inert plastic of the self conforming type.

G. Special Note: All sealants must be applied in ambient temperatures exceeding manufacturer's recommendations to insure proper setup.

H. Seal all penetrations with Manville Pyro-Fiber safing; or equal. Provide safing clips and joint sealant.

2.09 DUCT SYSTEM SEALING SCHEDULE

A. Supply, Return & Exhaust Ductwork: Completely seal all transverse joints and longitudinal seams.

B. Connection to Equipment: Use flanged connections to equipment, provide gasket to seal between flanges. Bent sheetmetal is not acceptable as a flange. Use steel angle or heavy gauge flat bar as a back up surface.

2.10 DUCT LINER

A. Furnish and install where indicated on drawings, acoustic duct liner.

B. Duct liner shall: made from flame attenuated glass fibers bonded with a thermosetting resin, air stream side to be coated with a non abrasive black surface. Furnish 2" thick, permacoat Linacoustic manufactured by Johns Manville; or equal. Duct liner rated for use at 250°F, 5000 fpm, with a k-factor of 0.25 and acoustical performance NRC of 0.70.

C. Ductwork having internal lining is not to be externally insulated, unless otherwise noted.

D. Any lined duct that has had water on the liner, shall be deemed unusable and will be required to be immediately removed from the site. The contractor shall provide an new section at no cost to the owner.

E. Note: Duct sizes shown are net inside duct dimensions, not including internal liner. Failure to comply with this requirement will be grounds for rejection.

2.11 FLEXIBLE DUCTWORK

A. Furnish and install where indicated on drawings, bi-directional reinforced metallized vapor barrier with triple ply stand-up seam; acoustically rated black CPE liner permanently bonded to a coated spring steel wire helix and supporting a thick blanket of fiberglass insulation. UL listed, Class 1 air duct. Flexible Tubing Division, Thermaflex, Type MKE; or equal. For connections to rectangular duct, use Bellmouth fittings with integral volume damper. Flex duct is not to be connected directly to rectangular main ducts. Duct centerline radius to duct diameter ratio not to exceed 1.5. Flex duct to have minimum R-value of 6.0.

B. Maximum length of flexible ductwork not to exceed 8'-0".

2.12 EQUIPMENT CONNECTIONS

A. All equipment shall be connected to ductwork with flexible duct collars.

B. Flexible connection shall be heavy glass fabric, coated with "Durolon", weighing approximately 24 oz. per sq. yard, as manufactured by Duro Dyne Corp.

1. For ducts 30" and below use 3" free length

2. For ducts above 30" use 5" free length.

2.13 TRIM FRAMES

A. Whenever ductwork passes through masonry, furnish and install mitered angle trim frames around ductwork to conceal rough masonry opening.

PART 3 - EXECUTION

3.01 APPLICATION

A. Properly seam, brace, stiffen, support and render ducts mechanically air tight. Where SMACNA plates and/or the specifications indicate duct stiffeners or reinforcing angles, they shall be continuous around all four sides and interlock at corners.

B. Adjust ducts to suit local conditions, and if necessary to accomplish this, dimensions may be changed, as approved, but maintain cross sectional area. Install ductwork so as to provide maximum headroom, unless otherwise noted on the drawings.

C. In addition to having all shop joints in ductwork fabricated in accordance with the Manual, all field joints shall be sealed air tight in accordance with the duct seal schedule.

D. Where turning vanes, balancing damper or any other kind of products are installed, ductwork must be reinforced at all four sides and interlocked at corners.

3.02 FLEXIBLE DUCTWORK CONNECTIONS

A. Flexible connections shall be made with tie straps as made by Panduit; or equal. Straps shall be used to clamp both inner and outer liner to diffuser and branch ductwork. (2) straps are required at each end of flexible ductwork.

3.03 CONNECTIONS TO MISCELLANEOUS DUCT EQUIPMENT

A. All duct connections to duct coils, etc. must be made with smooth transitions in accordance with SMACNA. Duct dimensions specified upstream and downstream (net free area) must be maintained. Sizing ductwork to match miscellaneous equipment is not acceptable, unless design conditions are met.

END OF SECTION

SECTION 233340 - PREFABRICATED DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including the General and Supplementary conditions and Division 1 Specifications Sections apply to the work of this Section.

1.02 SUBMITTALS

A. See Section 233330 for submittal requirements.

1.03 WORK INCLUDED

A. Note: Work in this section shall be in accordance with applicable provisions in Section 233330 - Low Velocity Ductwork.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Section 233330 - Low Velocity Ductwork

B. Section 233310 - Duct Hangers and Supports

C. Section 230713 - Ductwork Insulation

D. Section 230593 - Testing, Adjusting and Balancing

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect materials of this Section before, during and after installation and to protect installed 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 Engineer and at no additional cost to the Owner.

C. Delivery and Storage: Deliver all materials to the jobsite in their original unopened containers with all labels intact and legible at the time of use. Store in strict accordance with the manufacturer's recommendations.

D. Ductwork that is shop fabricated shall be delivered to the site in quantities acceptable to the storage area that the General Contractor has available.

PART 2 - PRODUCTS

2.01 SPECIALTY DUCTWORK

A. Round duct shall be double wall, insulated and acoustically lined. Duct shall have a galvanized steel outer shell of spiral lock seam construction, 1" 1.5lb./ft^3 fiberglass insulation and a perforated steel acoustical liner.

B. Retaining fabric between perforated liner and insulation shall be .008" thick, 15.6 lb./ft^3 density with air permeability rate 9.2 ft^3/SF.S.

C. Duct shall be of a spiral lock seam construction with a mechanically formed seam locking indentation evenly spaced along the spiral seam. All spiral duct 8" diameter and larger shall incorporate multiple corrugations between spiral seams. Duct shall be galvanized steel that conforms to ASTM standards A653 and A924 and be in accordance with SMACNA 2005 Duct Construction Standards and shall conform to SMACNA's MECHANICAL Duct Construction Standards for +10" water gauge pressure. Connection methods shall be slip-fit with all joints being sealed by the installer during the installation process. The type of sealant used as well as the method and level of application should be in accordance with the sealant manufacturer's published installation instructions and as specified in 233330. All fittings that are either spot-welded or button punched construction are internally sealed. All transitions and divided flow fittings which convert from flat-oval to round 60" diameter or less. Provide 1" lining where indicated on drawing.

D. Schedule for gauge of galvanized steel for outer shell and inner perforated liner:

	Inner Liner Diameter Solid Spiral Wound			
	3"-14"	16"-26"	28"-36"	38"-50"
Duct Outer Pressure Shell	26 ga.	24 ga.	22 ga.	20 ga.
Spiral Wound Inner Liner Duct	26 ga.	26 ga.	26 ga.	24 ga.

E. Ductwork described in this section shall be SPIROsafe double wall as manufactured by Lindab, Inc.; or equal.

2.02 DUCT CONNECTIONS

A. All double wall duct and fittings shall be provided with both an inner liner coupling and an outer pressure shell coupling for all connections.

B. Outer shell connections shall be by flanged joint. Inner liner connections shall be by slip joint couplings for duct to duct connections. Fitting liners shall be extended 2" beyond the outer shell to provide an inner liner coupling for duct to fitting connections.

2.03 HANGING SYSTEM

A. Cable hanging systems with adjustable mechanical devices shall be compliant with SMACNA MECHANICAL Duct Construction Standards Third Edition-2005, are allowed as replacement for threaded rod or strap, for both upper and lower attachments. Cable hangers may be used to suspend round ductwork. Select hangers for the type of structure and suspension, based on load ratings, and end fixings based on deck structure. Crimps shall be factory installed. All cable hanger products shall be certified as SMACNA and UL listed. All parts (including the cable) shall be supplied, warranted and proof tested by the same manufacturer, Gripple; or equal. Follow recommended factory installation guidelines; do not exceed safe working loads.

2.04 FITTINGS

A. Fittings shall also have a galvanized steel shell, 1" fiberglass insulation and perforated steel acoustical linings. Construction of fittings shall be die stamped, gored, pleated or mitered as shown on drawing.

B. All double wall fitting ends shall come factory equipped with a double lipped, u-profile, EPDM rubber gasket. Gasket shall be classified by UL.

C. Fasten ducts and fittings together with self tapping sheetmetal screws or pressure proof pop rivets.

PART 3 - EXECUTION

3.01 GENERAL

A. Installation shall be in accordance with manufacturer’s installation instructions.

END OF SECTION

SECTION 233710 - LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including the General and Supplementary Conditions and Division 1 Specification Sections apply to the work of this section.

1.02 SUBMITTALS

A. Submit product cut sheets, indicating performance data, sizes, accessories, etc.

B. Submit color chart for Architect's approval

PART 2 - PRODUCTS

2.01 LOUVERS

A. LO-1: Greenheck Model #ESJ-202; or equal, stationary formed aluminum louver, size as shown on drawings (flanged for metal walls, non-flanged for brick installations). 2" deep, blade with rain hook and lip at front and rear edges, 3" spacing at 37 degrees. Blades and frames of extruded aluminum construction with integral caulking recess. Blades shall be #6063-T5 aluminum. Louver to have anodized finish. Contractor shall furnish color selection as per Architect's instructions. Provide polyvinyl chloride coated wire bird screen 1/2" sq. mesh mounted on inside face.

B. LO-2: Greenheck Model #ESK-402; or equal, stationary drainable extruded aluminum louver, size as shown on drawings (flanged for metal walls, non-flanged for brick installations). 4" deep, drainable blade lip at front and rear edges, 4" spacing at 45 degrees. Blades and frame of .081" extruded aluminum construction with integral caulking recess. Blades shall be #6063-T5 aluminum. Louver to have anodized finish. Contractor shall furnish color selection as per architects' instructions. Provide polyvinyl chloride coated wire bird screen 1/2" sq. mesh mounted on inside face.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor to install louver in existing masonry opening and caulk between louver and wall and secure to wall.

B. Contractor to field verify exact masonry opening size prior to ordering louver.

C. GC to provide opening.

D. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. Schedule indicating drawing no., room location, quantity, size, throw, direction of throw, accessories, finish, material type, color chart, etc.

B. Product data sheet for each unit indicating throw, noise criteria ratings, directional data (four-way, etc.) material, accessories, mounting details, etc.

C. Noise criteria shall conform with specified equipment performance data.

D. If requested by Engineer, provide sample of diffuser, register, grille, etc.

1.03 GENERAL REQUIREMENTS

A. Duct drawings are diagrammatic and do not provide exact locations for diffusers, registers and grilles. Contractor shall reference reflected ceiling plans or instructions by Architect for a more exact location of diffusers, etc., with respect to ceiling grid, light fixture and sprinkler etc.

B. Each manufacturer shall check noise level ratings for their equipment to insure that the sizes selected will not produce noise to exceed 30 db, "A" scale, measured at occupant level; notify Engineer of any problems in this regard and change equipment size accordingly.

1.04 REQUIREMENTS FOR DIFFUSERS, REGISTERS AND GRILLES

A. All units and accessories shall be installed "sight-proof" where possible.

B. Borders and frames shall be of same material and color as specified for grille face.

C. Total quantity of air equally divided, or as required and/or shown, where diffusers blow in more than one direction. Provide blank off plate (finished to match unit) to match blow pattern shown on drawings.

D. Each supply register and diffuser shall be guaranteed to deliver indicated capacity and proper throw with draftless diffusion, and within acceptable noise level.

E. Limit terminal velocity at walls of room, below 25 fpm, measured 4' above floor.

F. Contractor shall provide proper duct connection to all diffusers, registers and grilles. Ductwork connections shall be as required by unit manufacturer. Connections required by Contractor include but are not limited to square/round adapter, transitions, flanges, neck rings, etc.

G. Because of intricate system designs and special performances required, all devices may not be of same make.

H. Suitable for recessed mounted unless otherwise indicated.

I. Diffusers and registers that are scheduled with integral opposed blade volume damper at neck must match unit construction and must be able to be adjusted through face, without removing unit.

J. Diffusers, registers and grilles do not require volume control dampers unless specifically indicated.

K. All exposed fasteners must be tamper proof.

L. Security Grille Face: Where indicated, provide heavy duty security type, tamper proof, secure grille face. Grille shall be 12 ga. thick cold rolled steel 1/2" sq. perforated grille. Fasteners shall be located 6" C/C around perimeter. Unit shall have white prime finish suitable for field painting. Provide A.J. Manufacturing Co.; or equal.

PART 2 - PRODUCTS

2.01 GENERAL

A. See drawings for schedule.

2.02 TRANSFER GRILLE ASSEMBLY

A. TG-1: Furnish and install where indicated on drawings, TG-1 assembly consisting of: (2) grilles, (1) fire damper and (1) duct sleeve. Each grille shall include plaster frame. Fire damper shall be 1-1/2hr, Air Balance Model #119AF; or equal. Locate as shown. Paint all visible interior surfaces flat black. Do not paint fire damper.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All equipment specified under this section shall be installed where called for on plans and in compliance with the contract documents.

B. Install equipment in strict accordance with manufacturer's instructions and so as to be compatible with intent of the respective system performance requirements.

C. Diffusers in lay-in type ceiling tiles shall be located at center of tile, squared with tile edges.

END OF SECTION

SECTION 237223.1 – INDOOR FIXED PLATE ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 SUBMITTALS

A. Schedule of units and accessories.

B. Unit capacities, ratings, weights, etc.

C. Dimensional shop drawings for units and accessories.

D. Sound power data.

E. Motor ratings. Motor efficiency shall comply to EISA standards.

F. Operation and maintenance manuals.

G. If unit is a substitution, provide 3/8"=1'-0" scale drawing with submittal indicating unit, coil removal, service area and surrounding ductwork and piping to prove substitute unit fits into intended space.

1.03 GENERAL REQUIREMENTS

A. Central station equipment and accessories shall be factory tested and certified by Air Conditioning and Refrigerant Institute (ARI). Units ratings shall comply with ARI 430 standards.

B. Units shall be factory assembled complete, and be ready to operate with all required and listed components necessary for proper operation.

C. Provide fan and motor drive assemblies with required accessories.

D. Units shall include internal vibration isolation. For units specified without internal vibration isolation, contractor shall furnish and install external isolators and related hardware.

PART 2 - PRODUCTS

2.01 Fixed Plate Energy Exchanger Units:

A. Product Specification:
Energy recovery ventilator (ERV) shall be a packaged unit and shall transfer both heat and humidity using static plate core technology.

Unit shall be Listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers. Some exceptions to UL Listing may apply.

The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of (1) year from the time of acceptance by owner.

B. Performance:

1. Energy Transfer: The ERV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.

2. Passive Frost Control: The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be required.

3. Continuous Ventilation: Unit shall have the capacity to operate continuously without the need for bypass, recirculation, pre-heaters or defrost cycles under normal operating conditions.

4. Positive Airstream Separation: Water vapor transfer shall be through molecular transport by hydroscopic resin and shall not be accomplished by "porous plate" mechanisms. Exhaust and fresh airstreams shall travel at all times in separate passages, and airstreams shall not mix.

5. Laminar Flow: Airflow through the ERV core shall be laminar over the products entire operating airflow range, avoiding deposition of particulates on the interior of the energy exchange plate material.

C. Construction:

1. The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.

2. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in both winter and summer conditions without generating condensate.

3. The unit case shall be constructed of G90 galvanized, 20-gauge steel, with lapped corners and zinc plated screw fasteners.

4. Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets. Pressure taps, with captive plugs, shall be provided allowing cross-core pressure measurement allowing for accurate airflow measurement.

5. Case walls and doors shall be insulated with 1", 4 lb. density, foil/scrim faced, high-density fiberglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibers, and with minimum R-value of 4.3 (hr·ft2·°F/BTU).

6. The ERV cores shall be protected by a MERV-8 rated, 2" nominal, pleated, disposable filter in both airstreams.

7. Unit shall have single-point power connection and a single-point 24 VAC contactor control connection.

8. Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed (TEFC) and be shall be supplied with factory installed motor starters. Direct drive models shall be EISA-compliant for energy efficiency with open drip proof design and integral thermal protection.

9. Blowers shall be quiet running, forward curve type and be either direct drive (EV450 and HE1X only) or belt drive. HE6X and HE8X units use backward incline, belt drive blower packages. Belt drive motors shall be provided with adjustable pulleys and motor mounts allowing for blower speed adjustment, proper motor shaft orientation and proper belt tensioning.

10. The unit electrical box shall include a factory installed, non-fused disconnect switch and a 24 VAC, Class II transformer/relay package.

11. The ERV shall be provided "inverter-ready" allowing for applications of inverters supplied and installed by others.

D. Options:

1. Provide double wall construction with 24-gauge galvanized steel liner.
2. Provide factory installed disconnect fuses.
3. Provide factory installed filter monitors for each airstream.
4. Provide MERV-13 filters for final installation after construction phase.

E. Vibration Isolation:

1. Provide rubber or spring type isolators appropriately sized for corner weights of the specific unit.

2. Provide flexible duct connections at unit duct flanges.

F. Controls: Controls by Temperature Control Contractor. See Specification Section 230994 for details.

2.02 MOTORS

A. All motors shall be general purpose squirrel-cage induction type, NEMA Design 8, Class 8 insulation, continuous duty, 40°C ambient, single or multiple speed as scheduled.

B. All three phase motors shall be NEMA Premium Efficiency design. Motor efficiency shall be indicated on the motor nameplate by the manufacturer per IEEE Standard 112 Method 8 in accordance with following tables:

Open Drip Proof (ODP)

Horsepower	1200 RPM	1800 RPM	3600RPM
1	82.5%	85.5%	77.0%
1.5	86.5%	86.5%	84.0%
2	87.5%	86.5%	85.5%
3	88.5%	89.5%	85.5%
5	89.5%	89.5%	86.5%
7.5	90.2%	91.0%	88.5%
10	91.7%	91.7%	89.5%
15	91.7%	93.0%	90.2%
20	92.4%	93.0%	91.0%
25	93.0%	93.6%	91.7%
30	93.6%	94.1%	91.7%

Totally Enclosed Fan-Cooled (TEFC)

Horsepower	1200 RPM	1800 RPM	3600 RPM
1	82.5%	85.5%	77.0%
1.5	87.5%	86.5%	84.0%
2	88.5%	86.5%	85.5%
3	89.5%	89.5%	85.5%
5	89.5%	89.5%	86.5%
7.5	91.0%	91.7%	98.5%
10	91.0%	91.7%	90.2%
15	91.7%	92.4%	91.0%
20	91.7%	93.0%	91.0%
25	93.0%	93.6%	91.7%
30	93.0%	93.6%	91.7%

C. Single speed motors shall operate at 1750 RPM unless otherwise indicated.

D. Motors controlled by Variable Frequency Drive (VFD) units shall be rated for inverter duty (NEMA MG1, Part 31).

PART 3 - EXECUTION

3.01 GENERAL

A. Install all equipment in strict accordance with manufacturer's instructions.

B. Field services shall be provided by a factory trained representative to fully set-up and adjust the new units, after the installations have been completed and before the units are placed in service. Written start-up report to be furnished. Factory alignment, mechanical seals, lubrication, three phase motor rotation, and all necessary commissioning tests shall be completed and checked before units are placed in service.

C. Provide one (1) complete spare set of filters for each unit. After building is complete and is fully occupied contractor shall remove and dispose of construction filter set and install new set.

D. Provide flexible duct collars to SA, RA and OA connections.

E. On units without internal vibration isolation, provide external spring isolators.

F. Provide all secondary steel necessary to mount units.

G. Lubricate bearings, pulleys, and other moving parts, with factory recommended lubricants.

H. Contractor is responsible for coordinating piping and motor locations (i.e. - L.H. or R.H.) to match drawings and/or actual job site conditions.

END OF SECTION

SECTION 237510 - VARIABLE REFRIGERANT FLOW SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary conditions and Division 1 Specification Sections, apply to work in this section.

1.02 SUBMITTALS

A. Shop drawings shall include certified manufacturer's dimensioned drawings for each chassis size specified including required clearances. Submit rated unit capacities, operating weights and accessories on all equipment in this section.

B. Submit parts list, operating, maintenance and installation instructions including unit support requirements.

C. Submittals shall be marked to identify specified information.

1.03 WORK SPECIFIED ELSEWHERE

A. 232300 - Refrigerant Piping & Specialties

B. 237500 - Packaged Rooftop Units

C. 237505 - Packaged Rooftop Units - Heat Recovery Units

D. 230993 - Temperature Controls

E. 230994 - Temperature Controls Software

F. 230995 - Control Wiring & Tubing

1.04 SPECIAL CONDITIONS

A. All equipment shall be by a single manufacturer. Equipment manufactured by multiple companies and packaged will not be accepted.

B. Supplier of equipment shall have established a service department, staffed by factory trained personnel, located within 180 miles of the project, which has been in continuous operation for the past (5) years.

1.05 GENERAL REQUIREMENTS

A. Furnish all labor, materials, equipment and services necessary for and incidental to the installation of all equipment as shown on the drawings and specified hereinafter. Unit supplier shall locally maintain factory trained technicians capable of servicing supplied units.

B. All equipment furnished shall be rated in accordance with ARI Standard 320 and shall be UL listed and labeled. Scheduled capacities and efficiencies are considered the minimum acceptable.

C. Motor efficiency shall comply with EISA standards.

D. Start up and Commissioning Requirements: The system must be started up and commissioned by a factory trained technician.

E. Quality Assurance:

1. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

2. All wiring shall be in accordance with the National Electric Code (NEC).

3. The system will bear the Energy Star label.

4. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturer: All equipment listed here in shall be a system manufactured by Daikin AC Company; or equal.

B. System Description:

1. The variable capacity, heat recovery air conditioning system shall be a variable refrigerant volume series (simultaneous heat/cool model) split system. The system shall consist of multiple evaporators using PID control, and VRV® outdoor unit. The outdoor unit shall have capacity as scheduled and include, direct expansion (DX), air-cooled heat recovery air-conditioning system. Variable speed driven compressor multi-zone spilt system. All indoor units are each capable of operating separately with individual temperature control.

2. The outdoor unit shall be interconnected to indoor units. The indoor units shall be connected to the outdoor utilizing REFNET specified piping joints and headers.

3. Refrigerant: the system shall use type R410A refrigerant

C. Warranty: The units shall have a manufacturer's warranty for a period of (1) year from date of installation. The units shall have a limited labor warranty for a period of (1) year from date of installation. The compressors shall have a warranty of (6) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of the manufacturer.

D. Operating Range: The operating range shall be as follows:

1. Cooling (°F): 23°F DB to 115°F DB (approximate)

2. Heating (°F): -3.5°F DB to 64°F DB, -5°F WB to 60°F WB

2.02 OUTDOOR UNIT DESCRIPTIONS

A. General: The outdoor unit is designed specifically for use with VRV series components.

1. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin scroll compressor, motors, fans, condenser coil, electronic expansion valve, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receivers and accumulators.

2. The outdoor unit can be wired and piped with unit access from left, right, rear or bottom.

3. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for re-programming.

4. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.

5. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature. Oil recovery cycle shall be automatic occurring 1 hour after start of operation and then every 6 hours of operation.

6. The outdoor unit shall be capable of heating operation at minimum dry bulb ambient temperature (see general section for parameters) without additional low ambient controls.

B. Unit Cabinet: The outdoor unit model shall be completely weather proof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

C. Condensing Fan:

1. The condensing unit shall consist of propeller type, direct-drive fan with 750 W motors.

2. The condensing unit fan motor shall have multiple speed operation via DC inverter, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG with available by field setting switch to a maximum 0.24 in. WG pressure.

3. The fan shall be a vertical discharge configuration with an air flow of 7,400 cfm.

4. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.

5. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. Condenser Coil:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchanger, rifled bore tube design to ensure highly efficient performance.

3. The coils shall be complete with corrosion treatment of an acrylic resin type. The thickness of the coating must be between 2.0 to 3.0 microns.

E. Compressor:

1. Each module shall include (2) scroll type compressors; (1) with inverter drive and (1) with a non-inverter drive.

2. The capacity control range shall be 14% to 100%, with 29 individual capacity steps.

3. The inverter driven compressor shall be variable speed controlled (PAM inverter) which is capable of changing the speed to follow the variations in total cooling load as determined by the suction gas pressure as measured in the condensing unit.

4. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC, hermetically sealed scroll type with a maximum speed of 6,480 rpm.

5. Both types of compressors shall be of the hermetically sealed scroll type.

6. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

7. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

8. Oil separators shall be standard with the equipment together with an oil balancing circuit.

9. The compressor shall be mounted to avoid the transmission of vibration.

2.03 INDOOR UNIT DESCRIPTIONS

A. Unit Cabinet:

1. Concealed unit in ceiling space with ducted SA, RA connections.
2. Galvanized steel casing.
3. Insulated with foamed polystyrene and polyethylene insulation.
4. Air filter, provide optional high efficiency filters.

B. Supply Fan:

1. Extremely low noise direct drive fan.
2. Variable speed DC inverter type fan motor.

C. Refrigerant Coil:

1. DX type coil with copper tubes expanded and mechanically bonded into aluminum fins.
2. Fin design shall be a waffle louver type with rifle bore tube.
3. Coil shall include a condensate pan.
4. Thermistor sensor shall be included on liquid and gas line.
5. Electronic expansion valve with 200 steps of controls.

D. Electrical Connection:

1. See schedule for required power input.
2. Factory wired single point connection.

2.04 BRANCH SELECTOR BOX ZONE VALVES DESCRIPTION

A. Used for heat recovery applications.

B. General:

1. These selector boxes shall be factory assembled, wired, piped, and run tested at the factory.

2. These selector boxes must be mounted indoors.

3. When simultaneously heating and cooling, the units in heating mode shall energize their sub cooling solenoid valve.

C. Unit Cabinet:

1. These units shall have a galvanized steel plate casing.

2. Each cabinet shall house multiple refrigeration control valves and a liquid gas separator.

3. The cabinet shall contain a tube in tube heat exchanger.

4. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.

D. Refrigerant Valves:

1. The unit shall be furnished with a 3-way refrigerant valve to control the direction of refrigerant flow.
2. Electronic expansion valves shall be used to control the variable refrigerant flow.
3. The refrigerant connections must be of the flare type.

2.05 REFRIGERANT NETWORK JOINT KIT DESCRIPTION

A. Factory assembled refrigerant network joint fittings for refrigerant branch connections of VRV units.

B. Fittings shall be configured as listed below:

1. Heat Pump Service: (1) gas side; (1) liquid side.
2. Heat Recovery Service: (1) suction gas side; (1) discharge gas side; (1) liquid side.

C. Fittings shall have multiple tube sizes for ease of field installation. Installer can field trim joint assembly to obtain actual refrigerant pipe size required for system.

D. Joint kits are intended for use with deoxidized phosphorous seamless copper pipe.

E. Fittings assemblies shall all include a pre-molded insulation cover at fitting joint location.

F. Joint kit shall be supplied with factory issued tool kit. Tool kit to include R410-A refrigerant pressure gauges; flare fitting tool and tubing cutter tool.

2.06 REFRIGERANT PIPING

A. Piping Materials: See Section 232300 - Refrigerant Piping & Specialties, for work requirements.

B. Exception: For VRF systems, modify the following material listing from Section 232300 as listed below:

1. 5/8" and below: Type K Seamless Soft Temp ACR Copper Tube

2. 7/8" and above: Type L Hard Drawn ACR Copper Tube

C. Piping Maximum Lengths: The system shall be capable of refrigerant piping up to 410 equivalent feet, a total combined length of 1000 feet of piping between the condensing and fan coil units with 165 feet maximum vertical difference, without any oil traps or additional equipment. In case where the outdoor unit is located below the indoor unit, the vertical difference is a maximum of 133 feet.

D. Insulation: Both liquid and suction lines must be individually insulated between the outdoor and indoor units with Armaflex type insulation.

E. Nitrogen Purge: All VRF refrigerant tubing shall be purged with nitrogen to clean out foreign material prior to vacuum evacuation process.

2.07 UNIT CONTROLS DESCRIPTION

A. General:

1. System control voltage shall be 16 V DC.

B. Multi-Zone Controller (DCS-3):

1. Model #DCS301C71
2. I-touch controller.
3. Controls multiple fan coil units.
4. Touch screen.
5. Equipped with interface ports for separate DDC control system.

C. Central Remote Controller (DCS-2):

1. Model #DCS302C71
2. Control groups of indoor units (max. 128 units).
3. Monitor status, temperature, setpoints.
4. Control zone occupied/unoccupied cycles (up to 64 zones).
5. LCD display.
6. Monitor fault conditions for all equipment.
7. Battery backup.

D. Schedule Timer (DST):

1. Model #DST301BA61
2. Control weekly schedules for equipment.
3. 7 day timer with max. 5 functions per day.
4. LCD display.
5. Battery backup (48 hours).

E. Simplified Wired Controller (TSRV):

1. Model #BRC2A71
2. Control of individual units.
3. LCD display.
4. User selectable mode start/stop, cool/heat/fan.
5. Battery backup (48 hours).
6. Temperature range 60°F to 90°F.
7. Fan speed setting.
8. Fault monitoring.

F. Remote Sensor Kit (RAS):

1. Model #KRCS01-1A
2. Wall /return air mount temperature sensor.
3. Thermistor type sensor.
4. Extension wiring kit, 2 conductor, 18 AWG, 39 ft. long.

G. Unification Adapter (DCS-1):

1. Model DCS302A
2. Turn On/Off the system from a control panel through centralized controller or i Touch Controller.
3. Monitor On/Off and error status.

H. Wiring Requirements:

1. The control voltage between the indoor and outdoor unit shall be 16 VDC non-shielded 2 conductor cable.

2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.

3. Wire Type: 2 wire, non-polarity, non-shielded. The control wiring lengths are:

Wire Run	Control Wiring Length (max.)
Outdoor to Indoor Unit	6,665
Outdoor to Central Controller	3,330
Indoor Unit to Remote Control	1,665

4. Wiring accessible concealed spaces can be run as open wiring, see Section 230995.

5. Wiring for VRV systems can be installed with refrigerant piping runs, enclosed inside thermal insulation as per manufacturer's recommendations.

6. Wiring diagrams and Sequence of Control including I/O Listing can be found in specification 230993 and Contract Drawing H-700s.

PART 3 - EXECUTION

3.01 GENERAL

A. All equipment shall be installed in strict compliance with manufacturer's instructions.

B. Install units level and firmly anchored in indicated locations.

C. Furnish wiring diagrams to Electrical installer for power wiring to units.

D. Start-Up Services:

1. Field services shall be provided by a factory trained representative to fully set-up and adjust the new units, after the installations have been completed and before the units are placed in service. Written start-up report to be furnished.
2. Factory alignment, lubrication, motor rotation, and all necessary commissioning tests shall be completed and checked before units are placed in service.

E. Control System Configuration: Contractor shall obtain the services of a factory trained technician to setup and configure all controls for the project. Configuration shall include setup of program parameters for weekly occupied/unoccupied schedules and all timed events; and shall also include programming all other parameters, i.e. all temperature setpoints.

F. VRV Configuration Parameters: Contractor shall have factory trained start up technician configure the following special parameters for the project in all noted spaces.

G. Office/Administrative Spaces:

Function	Settings
On/Off Button	Enable
Room Temperature Display	Allowed
Setpoint Temperature Display	Turn On
Room Setpoint Adjustment	Enable
Setpoint Adjustment Bias	Allow 2°F / 2°F Bias
Fan speed Switch	Set to automatic - disable manual function
Operation Mode Selector Button	Disable

H. Class Room Spaces:

Function	Settings
On/Off Button	Disable
Room Temperature Display	Allowed
Setpoint Temperature Display	Turn Off
Room Setpoint Adjustment	Disable Note: input fixed setpoint temperature
Setpoint Adjustment Bias	Allow +1.5°F / -1.5°F Bias
Fan speed Switch	Set to automatic - disable manual function
Operation Mode Selector Button	Disable

END OF SECTION

SECTION 238215 - DUCT MOUNTED COILS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this section.

1.02 SUBMITTALS

A. Schedule of all equipment and accessories.
B. Coil operating and performance data.
C. Product data sheets.
D. Dimensional arrangement drawings, including connection details.

PART 2 - PRODUCTS

2.01 ELECTRIC COILS

A. All equipment shall meet applicable provisions of National Electric Code and units shall be listed with Underwriters Laboratories. See drawings for duct sizes and arrangement.

B. Elements: Open coil type, 80% nickel, 20% chromium Type A resistance wire. Coils shall be supported by ceramic bushings. Terminals and hardware shall be stainless steel. Elements shall be spaced to provide full duct cross sectional coverage.

C. Housings: Frames and housings shall be galvanized steel. Terminal box and control enclosures shall be side mounted, NEMA 1 type. Doors to enclosures shall be hinged, latching type.

D. Controls: Furnish all units with the following controls:

1. Automatic reset thermal cutout switch for primary over-temperature protection.
2. Manual reset thermal cutout switch for secondary over-temperature protection.
3. Door interlocked, cover mounted safety switch to disconnect unit. Front door opened when disconnect is in ON position.
4. Air flow switch to prove air flow, switch shall de-energize unit on loss of airflow.
5. Contactors for each stage of heating shall be provided. Contactors shall be mercury type.
6. Control circuit transformer.
7. Each stage of heat shall have fuse blocks and fuses.
8. All internal wiring shall be stranded copper rated at 105°F. Provide terminal blocks for all field wiring.

E. Side connections to fit headroom requirements and appearance.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide all secondary steel and hangers required for proper installation and support.

B. Install all coils in strict accordance with manufacturer's instructions.

C. Support coils independent of ductwork and piping; coil shall not carry duct or piping loads.

D. Coil and ductwork (minimum 3'-0" upstream and downstream) shall be externally insulated regardless if it is lined duct or not. See ductwork insulation specification.

E. Provide duct access doors on inlet and discharge side of coil.

END OF SECTION

SECTION 238239.13 - CABINET UNIT HEATER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work in this section.

1.02 SUBMITTALS

A. Schedule of equipment accessories.
B. Arrangement drawings for each unit configuration.
C. Performance data, product data sheets.
D. Wiring diagrams.
E. Color Chart.
F. Parts List, Operating and Maintenance Instruction Manuals.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All equipment tested for not less than 125 psig minimum hydrostatic pressure, unless otherwise specified. Free from expansion and contraction noises and strains. Fan speed on Schedule is an indication of sound rating and shall not be exceeded. All exposed parts to be cleaned and bonderized or phosphate coated before prime coating or baked enameling. Cabinet unit heaters shall have color and finish as selected by Architect from the manufacturer's standard colors. Rating in accordance with standard test codes adopted jointly by IUGA and ASHRAE. Required capacities are shown in Schedule and Plans.

B. Provide cabinet unit heaters suitable for use with hot water or steam in accordance with schedule and/or as shown on plans.

C. Space requirements must not exceed that of design unit.

D. Furnish blow-thru cabinet heaters, with compartments available for temperature controls and piping. Locate electric connections in end of unit opposite coil connection.

E. Decorator units to have phosphatizing treatment prior to applying semi-gloss baked enamel finish. Grilles to be fabricated steel using rolled steel blades with chamfered ends.

F. Fans: Forward-curved, double-inlet centrifugal of aluminum construction and modular design. Motor and fans mounted on removable galvanized fanboard.

G. Motor/fan assembly to be direct drive. Two-fan units to have double extended motor shafts, three speed, shaded pole motors.

H. Motor efficiency shall comply with EISA standards.

I. Motor: to be hard wired; built-in motor overload protection with automatic reset.

J. Coils: 2-row, constructed of copper tubing mechanically expanded into aluminum fins. Joints to be brazed with high temperature silver alloy. Water coils to have plugged drain tube and vent tube extended into unit end compartment. Provide manual air vent. Coils to be field reversible.

K. Provide 1" thick, throw-away filters.

L. Controls: Provide fan speed switch (Off-High-Low). For wall mounted units: Provide integral thermostat. Fan switch and thermostat shall be adjustable through face of unit with allen wrench.

M. Note: Thermostat for ceiling mounted units by controls contractor.

N. Provide unit with manufacturer's toggle type disconnect switch that is factory mounted and wired.

2.02 ELECTRIC CABINET HEATERS

A. Heating element shall be steel finned metal sheath.

B. Controls: Factory wire power connections with disconnect switch and safety controls listed herein.

C. Dead front switch to shut off heating elements when cover open.

D. Silent operation mercury contactor(s) for each stage of heat.

E. Automatic reset high limit switch to open heater circuits when maximum temperature exceeded. Interlock to prevent heaters from energizing if blower not operating.

F. Provide circuit breaker(s) for each heating circuit. Heating circuits shall not exceed 48 amps. Provide number of multiple circuits with circuit breakers and contactors as required to limit circuits to 48 amps.

G. Fan and Motor: propeller or centrifugal type with totally enclosed and permanently lubricated fan motor.

H. For wall mounted units, unless noted otherwise, provide integral thermostat with tamper proof adjustment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Refer to Architects at once, any correction, discrepancy or suggested change in size or location.

B. Install all equipment in strict accordance with manufacturer's instructions.

C. All enclosures fastened to structure with screws, bolts, etc., no nailing allowed.

D. All cabinet parts cleaned, bonderized, phosphatized, and painted with baked on enamel standard finish, subject to Architects approval.

E. Hydronic Units: Isolate unit with valves to permit servicing of control valves, strainers, etc.

F. Contractor responsible for correct end connections and coil arrangements, with respect to installation of control valves, vents, etc.

G. Provide manual air vent on return end of each heating unit on all hot water installations.

H. Electric Units: Manufacturer shall furnish and install disconnect for electric elements to be mounted inside cabinet.

END OF SECTION

DIVISION 26, AND 28
ELECTRICAL SPECIFICATIONS (EC)
INDEX

SECTION	TITLE
260010	ELECTRICAL WORK GENERAL
260015	ELECTRICAL DEMOLITION
260016	TEMPORARY ELECTRIC POWER
260190	SUPPORTING DEVICES
260195	ELECTRICAL IDENTIFICATION
260519	WIRE & CABLE (600V AND BELOW)
260533	CONDUIT
260534	SURFACE RACEWAYS
262400	POWER DISTRIBUTION
262726	WIRING DEVICES
265010	LIGHTING
275116	PUBLIC ADDRESS SYSTEM RENOVATIONS
283111	FIRE ALARM SYSTEM RENOVATIONS

SECTION 260010 - ELECTRICAL WORK GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

1.02 ALLOWANCES, ALTERNATES AND UNIT PRICES

A. Refer to Division 1 specifications for allowances, alternates and unit prices required as part of this Contract.

1.03 INTENT

A. The intent of the drawings and these specifications is to provide all systems complete and operative. Whether indicated on the drawings and/or included in the specification or not, provide all materials, equipment and labor usually furnished with such systems.

1.04 DEFINITIONS

As Called for	Materials, equipment including the execution specified/shown in the contract documents.
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Design Make	Indicates minimum requirements for equipment.
ERL	Existing to be relocated. (see definition of relocate).
EXR	Existing to remain. Make connections to maintain circuit.
Exposed	Work not identified as concealed.
Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
Furnished by Others	Receive delivery at job site or where called for and install.
Inspection	Visual observations by Owner's site Representative.
Install	Mount or set equipment, device or fixture and make electric connections.
Labeled	Refers to classification by a standards agency.
Make	Refer to the article, BASIS OF DESIGN.
Provide	Furnish and install complete.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.

Replace	Remove and provide new item.
Review	A general contractual conformance check of specified products.
Roughing	Pipe, duct, conduit, equipment layout and installation.
Satisfactory	As specified in contract documents.
Site Representative	Construction Manager or Owner's Inspector at the work site.

Refer to General Conditions of the Contract for additional definitions.

1.05 SCOPE OF WORK

A. In general, the scope of work includes, but is not necessarily limited to the following:

1. Grounding of all services, raceway systems, disconnects and devices, etc.
2. Interior lighting, wiring, conduits and switching.
3. Power and convenience outlet branch circuits, devices, etc.
4. Exit and emergency lighting.
5. Power circuits to mechanical equipment.
6. Fire Alarm and Public Address renovations.
7. Removal work.

1.06 BASIS OF DESIGN

A. The contract documents are prepared on basis of one manufacturer as "design equipment," even though other manufacturers' names are listed as acceptable makes. If Contractor elects to use one of the listed makes other than "design equipment," submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger electrical feeders, circuit breakers, equipment, additional control devices and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace door frames, access doors, walls ceilings or floors required to install other than design make equipment. If revised arrangement submittal is rejected, revise and resubmit specified "design equipment" item which conforms to contract documents.

1.07 QUALITY ASSURANCE

A. Manufactures of equipment shall be firms regularly engaged in the production of factory fabricated systems and equipment whose products have been in satisfactory use in similar service for not less than (3) years.

B. Suppliers of equipment must have factory trained and authorized personnel for the service of all equipment provided

1.08 LICENSING

A. Where required the contractor shall hold a license, issued or recognized by the authority having Jurisdiction, to perform electrical work.

1.09 INSPECTIONS

A. Provide rough in and final inspection by an electrical inspector certified by the AIAEI (the American International Association of Electrical Inspectors).

1.10 REMOVAL, DISPOSAL AND HAZARDOUS MATERIALS

A. All removed electrical equipment shall be removed from the site and properly disposed of.

B. All hazardous materials must be disposed of in compliance with ENCON and all other regulatory agencies.

C. The Owner may wish to keep certain equipment, therefore, check with Owner before removals to determine what may be salvageable.

1.11 TEMPORARY SERVICES

A. Contractor shall provide a complete temporary light and power service in accordance with requirements of specification section 260016 - Temporary Electric Power.

1.12 CONTINUITY OF UTILITY SERVICES

A. It is of paramount importance that each utility service operate continuously and without interruption. Whenever this contractor plans to make changes or alterations to any existing utility service, such plans shall result in no or minimum service interruption or inconvenience to Owner. This contractor shall plan and schedule any change or alteration to an existing utility service with Architect and Owner. Such planning, timing, and/or scheduling shall be approved by both these parties.

1.13 CODES AND STANDARDS

A. New York State Uniform Fire Prevention and Building Code: Provide all work in compliance with and meet the requirements of the latest issue.

B. National Electrical Code: All work covered under these Contract Documents shall conform to the 2020 National Electrical Code.

C. Standards: All equipment shall meet all the requirements of ANSI, NEMA, IES, and IEEE standards.

D. Listing: All equipment and devices for which Underwriters' Laboratory has a listing service, shall be UL listed and bear the UL listing label.

E. All materials and installation shall comply with:

1. Building Code of New York State.
2. Energy Conservation Construction Code of New York State.
3. Fire Code of New York State.
4. National Fire Protection Association (NFPA).
5. New York State Department of Labor Rules and Regulations.
6. The Americans with Disabilities Act.
7. Local Utilities.
8. New York State Department of Health.
9. Local Municipality/City Codes and Ordinances and the Authority Having Jurisdiction.
10. Local Fire Department.
11. Insurance Carrier.
12. New York State Department of Education.

1.14 SUBMITTALS & SUBMISSION REQUIREMENTS

A. All submittals shall be in accordance with Division 1 requirements, the following requirements listed below, and also as indicated in each specification section. All submittals not complying with the listing above will be returned to the contractor without being reviewed. Rejection by Architect or Engineer of any items submitted shall require resubmittal of acceptable items.

1. Within (30) days after receiving signed contract or notice to proceed, submit to Architect for review complete descriptive dimensional data and ratings for equipment and materials proposed to be furnished and installed. Submit (8) copies of data unless otherwise specified by the architect.

2. All materials submitted shall clearly state the job name and specification section(s) that it applies to.

3. Any package containing more than one piece of equipment or material shall also contain a schedule clearly listing all items in submittal. Schedule page (s) shall also indicate project name and building name.

4. All submittals must be clearly marked using nomenclature used in this specification for proper item identification, schedule of usages, model numbers, construction materials, performance, data, etc.

5. Projects involving multiple buildings must have the submittals separated by building. Submittals in which buildings are combined will not be accepted. (Exception: When specifically approved by engineer, basic materials may be submitted once.)

6. The Contractor shall insure that dimensions of equipment to be used conform to the space allocated for the equipment on the drawings.

7. Submittals traced or copied from contract drawings are not acceptable and will be returned without review.

8. In the event material and/or equipment is installed prior to obtaining approval of shop drawings, and in the sole opinion of the Owner's Agent, this material and/or equipment does not meet the specifications, the Contractor shall be liable for the removal and the replacement at no additional cost to the contract.

B. Samples: When requested by Engineer, provide samples of both specified equipment and proposed substitutions for review by the Owner's Agent. Such equipment shall be delivered to a location designated, or erected at the job site as directed. When neither is physically possible, arrange for the Owner's Agent to visit an acceptable site where the proposed equipment can be inspected.

C. Substitutions:

1. Submittals for equipment or materials other than as specified shall be accepted for review by the Owner's agent.

2. Approval of substitute equipment shall be based on functional, physical and aesthetic compatibility to the equipment specified as determined by the Owner's agent and approved by the engineer.

3. Where substitute equipment is approved, the contractor shall be responsible for, and bear the cost of any necessary changes by his trade or other trades to make the system complete and operable.

4. Contractor is fully responsible for providing coordination between all trades affected by equipment substitution.

5. When requested, contractor shall submit layout drawings indicating new dimensions and arrangements of substituted equipment. Layout drawings shall indicate all revisions necessary for all services affected by substitution.

1.15 SUBSTANTIAL COMPLETION REQUEST FOR PUNCH LIST

A. Contractor shall submit a letter in email form stating that the work is substantially complete and ready for Punch List review by Engineer.

B. Contractor shall note which areas are substantially complete by Building (if multiple buildings) and by Area according to the Key Plan.

C. Contractor shall list all items that are known to be incomplete at time of submission.

D. If the request is for a partial Punch List, Contractor shall also include a list of room numbers/room tags.

E. When letter is received by the Engineer, site review(s) will be coordinated with the Construction Manager, Clerk, Architect.

1.16 FIELD INSPECTION

A. As there are various conditions at the site which do not show on the accompanying drawings, or which are at variance with the conditions indicated on the drawings, it is important that each bidder visit the site and acquaint himself with existing conditions, and take these conditions into consideration when preparing his proposal. Each bidder shall obtain information or make any measurement desired. Lack of knowledge relative to existing conditions will not be allowed as a basis for extra compensation.

B. This contractor and his subcontractors shall inspect existing equipment to remain prior to any of his new work in order to determine that all equipment is in good operating condition. If equipment is found to be lacking components, is inoperable, damaged, etc., contractor shall provide immediate written notice to the Owner. The Owner or his representative shall determine if any additional work is necessary and the method by which any work shall be performed.

1.17 PERMITS, CERTIFICATES AND FEES

A. This Contractor shall obtain and pay for permits, certificates, fees etc. listed below. Costs for permits, fees etc. shall be included in the base bid amount.

1. All required applications and permits to begin work.
2. Certificate of inspection including Third-Party Agency.
3. All municipal connection charges.
4. All local utility charges (power, telephone, cable, etc.).
5. Fees and charges shall be obtained directly from the respective authority having jurisdiction.

1.18 GUARANTEE

A. Contractor shall guarantee all work furnished through this contract including work performed by sub-contractors, for a period of (1) year (unless otherwise noted), from the date of final acceptance. Contractor agrees to repair or replace any defective work or materials at no additional cost to the Owner. Contractor shall also pay for any damage to other work resulting from repairs to defects. Contractor shall furnish written guarantees to the Owner's agent in accordance with the general conditions.

1.19 TESTING AND INSPECTION

A. Inspections required for any ordinances, regulations, instructions, laws, rules, standards and practices that require any work to be inspected or tested shall be performed. Contractor shall give Owner, Architect and Engineer timely notice of readiness of work for inspection or testing and the date fixed for said inspection or testing.

B. Third-Party Agency must inspect completed installation and present Owner with Certificate of Inspection showing approval.

C. Required local or municipal inspection. Process and present Owner with certificate indicating approval of such governing bodies.

D. Contractor shall submit a written report to Architect, copy to Engineer, on results of each inspection or test on system or equipment supplied. Report shall contain all pertinent information, recommendations, approvals, additional work required, etc.

E. Contractor is responsible to check rotation on all three phase equipment prior to turning on equipment for temporary or permanent use.

F. Panelboard, Circuit Breaker, Transformer and Fuse Tests:

1. Energize all possible lighting and equipment loads for a period of not less than eight hours.
2. Check all fuses and circuit breakers for faulty tripping and excessive heat.
3. Tabulate phase current on all feeders.
4. Tabulate voltages at each panelboard (phase to phase and phase to neutral).
5. Reconnect branch circuits that vary over 5% between high and low current.
6. Reconnect transformer taps as required to adjust for high or low voltages.
7. All tabulation sheets shall be presented to the Architect for approval, make any corrections determined by the Architect.

1.20 RECORD DOCUMENTS

A. When required by general conditions or other Division 1 Section this Contractor shall prepare and turn over to Owner's agent record as-built documents. As-built drawings will include actual equipment location layout, service connections, etc.

B. In all projects, contractor shall provide record drawings of all underground equipment and service runs. As-built drawings for underground work will include dimensions to actual locations finish grade elevations, and actual invert to underground structures equipment and service runs.

1.21 PENETRATIONS THRU FIRE RATED CONSTRUCTION

A. All penetrations by this contract through rated construction shall be sealed fire safe by a UL listed approved method.

B. All electrical penetrations through walls, floors, etc. shall be conduit sleeved.

C. All conduit penetrations through fire rated partitions, walls, floors, etc. shall be installed as follows; penetration shall be oversized 1/2" to 3/4" maximum. This Contractor shall pack with fireproofing insulation, type FS cerablanket. Outside of penetrations shall be caulked and sealed with flame stop V, as manufactured by Flame Stop, Inc.; or an approved equal. Flame stop sealant shall be troweled smooth for finishing as required.

1.22 CONFINED SPACES

A. All work in pipe tunnels, mechanical pits, well manholes, etc. shall be performed by skilled tradesman and laborers with current certification for working in confined space. Contractor shall bear all costs to provide all safety equipment, ventilation, etc. as required by State and Federal Regulations and shall obtain all necessary permits for such work.

B. Contractor shall submit copy of current certifications and photo I.D. of all tradesman and laborers who will be working in confined spaces on this project.

1.23 INTENT OF DRAWINGS

A. The drawings are diagrammatic, unless detailed dimensioned drawings are included. Drawings show approximate locations of equipment, fixtures, panelboards, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, and the panelboard or interconnection box from which the branch circuit is served.

B. Drawings show general design and arrangement. Verify exact location and elevations at the job location. Do not scale plans and diagrams.

C. Drawings do not show all offsets, fittings, 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. Prior to roughing in any back boxes for power or communications devices, thoroughly examine the architectural elevations, enlarged plans and details. Also exam vendor drawings and manufacturer instructions for equipment furnished by others or as part of this contract. Install back boxes in locations and at heights as indicated on these documents. If the locations are not detailed, issue an RFI to the construction manager to obtain them. Boxes that are roughed in without detailed location and heights will re-located at no additional cost to the contract by the electrical contractor.

E. Cooperate with all Contracts and Owners and determine the exact route of all raceway and location of all equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

B. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems conform to the Specifications.

2.02 U.L. LISTING

A. Equipment shall bear the Underwriter’s Laboratories (UL), or other approved agency listing label. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with the National Electric Code and listed by U.L.

2.03 FIRE STOPPING

A. Fire-stopping for Openings through Fire and Smoke Rated Walls and Floor Assemblies shall be listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems." The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.
2. Nelson Electric Fire-Stop System Putty, CLK and WRP.
3. Thomas & Betts - S-100 FS500/600.
4. Carborundum Fyre Putty.
5. Hilti Firestop Systems.

PART 3 - EXECUTION

3.01 ROUGHING

A. Obtain approved roughing diagrams and exact locations of equipment for items furnished under other Divisions of the specifications. Do not rough in without approved drawing.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, etc. Verify final locations for rough-ins with field measurements and with the equipment being connected. Verify exact location and elevations at work site prior to any rough in work. DO NOT SCALE PLANS. If field conditions, details, changes in equipment or shop drawing information require a significant change to the original documents, contact the owners' representative for approval before proceeding.

C. All equipment locations shall be coordinated with other trades to eliminate interference with required clearances for equipment maintenance and inspections.

D. Coordinate work with other trades and determine exact routing of all duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Verify with Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other contracts, obtain from Architect and other Contractors, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. Obtain written authorization from the Owners representative or other contractor for any "rough ins" that, due to project schedule, are required before approved coordination drawings are available. Any work installed without written authorization or approved coordination drawings, causing a conflict will be relocated by the electrical contractor at no expense to the Owner.

F. For equipment and connections provided in this contract, prepare roughing drawings as follows:

1. Existing equipment being relocated: Measure the existing equipment and prepare drawings for installation in new location.

2. New equipment: Obtain equipment roughing drawings and dimensions, then prepare rough-in drawings.

3. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and/or furnish other equipment as required for ample maintenance space. Any changes in the size or location of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

4. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Contractor shall relocate existing work in the way of new construction. VISIT SITE BEFORE BIDDING TO DETERMINE SCOPE OF WORK. Provide new materials, including new piping and insulation for relocated work.

3.02 CUTTING AND PATCHING

A. This contractor shall bear the cost of all cutting and patching required by and for the installation of this work. This contractor shall perform all cutting and patching unless otherwise indicated on drawings or if directed by the Architect.

B. Patching of fire rated floors, walls, partitions, etc. shall be made using new materials equal to the fire rating of the existing.

C. Should changes, omissions or errors in electrical work require cutting, patching or making alterations in any portion of new construction, such work will be performed by GC at contractor's expense.

D. Cutting and patching of roof surfaces and structures shall only be performed by a qualified contractor, as approved by the Architect. The work of this contract shall bear the cost of above mentioned cutting and patching. This contractor shall insure that existing roof warranties remain in force.

E. This contractor shall furnish lintels, sized to accommodate structure above opening, where cutting and patching is to be performed on load bearing walls. Contractor shall obtain written approval for all lintels prior to installation.

F. Cutting shall be done in a manner which will not adversely affect the strength of the building. Holes and openings shall be neatly cut so as to provide a finished appearance and shall be patched around the edge where required for a finished appearance. Provide temporary bracing, shoring, etc. as required.

G. Patching shall be structurally sound and match the existing materials and finish of adjacent materials. Patching is required in finished areas, wherever existing work is removed, at the sides of openings, etc. Patching shall include repairs, painting, etc.

H. At the completion of the work, all evidence of alteration will be as inconspicuous as possible

3.03 OPENINGS, SLEEVES, AND CHASES

A. Certain chases, openings, and shafts will be provided as shown as part of General Construction Plans and Specifications.

B. Provide all other openings and sleeves for conduit etc. through floors, walls, partitions, ceilings, roofs, etc. for Division 26-E work.

C. Assume responsibility for correct and final location and size of such openings; furnish templates if required. Correct improperly located and sized or omitted chases and openings as required. Plug all abandoned sleeves left as part of this Contract.

3.04 SEALING AND FIRESTOPPING

A. Installation of Fire-stopping for Openings Through Fire and Smoke Rated Walls and Floor Assemblies shall be as follows:

1. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for dry wall construction.

2. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

3. The methods used shall incorporate qualities that permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

4. Provide rigid steel sleeves where non-armored cables pass through fire rated walls and barriers.

3.05 SUPPORTS

A. Provide required supports for work of this Contract, including beams, angles, channel, hangers, rods, columns, plates, bases, braces, etc. to properly support all work.

B. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, pendant-mounted lighting fixtures, etc.

C. Panelboards, cabinets, large pull boxes, cable support boxes and starters shall be secured to ceiling and floor slab and not supported from conduits. Small panelboards, etc., as approved by Owner's Representative, may be supported on walls. Racks for support of conduit and heavy electrical equipment shall be secured to building construction by substantial structural supports.

D. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, securely bond to floor by roughening slab and coating with cement grout. Bases 2" high; shape and size to accommodate equipment. Set anchor bolts in sleeves before pouring and after anchoring and leveling, fill equipment bases with grout.

E. See Specification Section 260530 – Supporting Devices for additional requirements

3.06 CONCEALMENT

A. Unless otherwise specifically indicated, all work shall be concealed above ceiling space, in wall space, below slabs in crawl spaces, and elsewhere throughout the building.

B. In areas with no ceilings, install only after Architect reviews and comments on arrangement and appearance.

3.07 TEMPORARY LIGHT AND POWER

A. Provide temporary electric system as called for in specification section 260016.

B. The fire alarm system must be maintained at all times. Provide additional portable batteries or small 1500 watt portable generator.

3.08 ROOF AND ROOF DECK CUTTING AND FLASHING

A. All penetrations through roofing and decking shall be accomplished by the roofing manufacturer‘s Certified Roofing Contractor in order to maintain roof system warranty.

3.09 EQUIPMENT INSTALLATION

A. All installations shall comply with the following requirements:

1. Provide code required disconnects for all electrical equipment that is furnished or connected by the electrical contractor.

2. Coordinate electrical systems, equipment, and materials installation with other building components. Be responsible for any changes in openings and locations necessitated by the equipment installed.

3. The architect shall control the placement of all wall and ceiling mounted electrical equipment and devices in all rooms with the exception of mechanical and electrical equipment rooms. When drawing details are not available, consult with the Architects representative for actual location.

4. Verify all dimensions with field measurements.

5. Arrange for all chases, slots and openings in other building components that are not indicated on drawings, to allow for electrical installations.

6. 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.

7. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the construction schedule. Pay close attention to equipment that must be installed prior to building enclosure.

8. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

9. Install systems, materials and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer the conflict to the Architect.

10. Store Materials on dry base, at least 6" above-ground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.

11. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

12. All tolerances in alignment and leveling, and the quality of workmanship for each stage of work shall be as required by the manufacturer and subject to approval by the owners representative.

13. All finished equipment surfaces damaged during construction shall be brought to “as new” condition by touch up or repainting. Any rust shall be removed and primed prior to repainting.

14. Workmanship shall be as called for in the “Standard of Installation” published by the National Electrical Contractors Association (NECA).

15. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.

16. No electrical equipment shall be hidden or covered up prior to inspection by the owners’ representative. All work that is determined to be unsatisfactory shall be corrected immediately.

17. All electrical work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

18. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his approval. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

19. Install access panel or door where units are concealed behind finished surfaces.

B. Provide complete power connections to all electrical equipment. Provide control connections to equipment where indicated on the drawings. Provide disconnect ahead of each piece of equipment. Ground all equipment in accordance with the latest version of the National Electrical Code.

C. Provide all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required for proper equipment operation of Owner-Furnished Equipment and Equipment furnished by other contracts,

D. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding and confirm prior to roughing.

E. This contractor shall coordinate scheduling and installation of work with other contractors, sub-contractors and other trades. The contractor is also required to coordinate all work with owner supplied materials, direct contracts, and normal building operations, if any.

F. All finished work shall be neat and workmanlike. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade. New systems shall be delivered to Owner complete in perfect working order, tested and balanced in full accordance with plans and specifications. Existing systems shall function in same manner as before this work was performed. Any malfunctions which arise in existing systems as a result of demolition or alteration of parts of such systems shall be corrected.

G. Layout of equipment, accessories and electrical systems in plan is generally diagrammatic unless specifically dimensioned or detailed. Check project drawings and existing site conditions before installing work for interference's as governed by structural or other conditions. Owner reserves the right to make reasonable changes in location of equipment, accessories or electrical systems prior to "roughing-in" without involving additional expense. Exact dimensions shown upon plans will be subject to verification and confirmation of exact conditions at site at time of construction. "Plus or minus" dimensions are shown upon drawing as a guide only. Exact surrounding conditions are governed by final equipment selection and/or other like details.

H. Furnish all new equipment and materials as described herein. Any material, operation, method or device mentioned, listed or noted within this specification, if not specifically mentioned as furnished or installed by others, shall be furnished and installed by this contractor.

3.10 REMOVAL OF BALLAST IN EXISTING LIGHT FIXTURE

A. Assume ballasts contain PCB materials unless labeled otherwise, or test samples to show materials are not PCB; submit test report. Remove all ballasts from existing light fixtures indicated on contract documents. Dispose of all ballasts which do not have non-PCB labels in PCB containers, and pay all costs to have containers taken to EPA-approved incinerators and disposed of per all EPA regulations. Follow all EPA regulations for transporting containers and materials. If ballast has leaked in existing fixture, remove material deposited in fixture, and dispose of those materials as listed above. Provide Certificate of Disposal and all associated paperwork to Owner’s Representative.

3.11 FIRE ALARM DETECTOR COVERS

A. Electrical Contractor is responsible to provide dust covers on all detectors whether new or existing in any area of construction. This shall be done in any area of construction even if there is no electrical work being done in this area. Coordinate with all trades.

3.12 ROOF PENETRATIONS

A. Electrical Contractor is to refer to Division 7 for warranty requirements on existing roofs prior to any roof penetrations made.

3.13 PAINTING

A. This Contract Includes the following:

1. Painting for all cut and patch work performed as part of Division 26 contract.
2. Painting required for touch-up of surfaces damaged due to the installation of electrical work.
3. Painting as required to repair finish of equipment furnished.
4. Painting of all surface mounted raceways in finished areas.

3.14 CLEANING

A. After all tests are made and installations completed satisfactorily:

B. Thoroughly clean entire installation, both exposed surfaces and interiors.
C. Remove all debris caused by work.
D. Remove tools, surplus, materials, when work is finally accepted.

3.15 CONTINUITY OF SERVICES

A. The building will be in use during construction operations. Maintain existing systems in operation within all rooms of building at all times. Refer to "General Conditions of the Contract for Construction" for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner's Representative. Provide, as part of contract, temporary mechanical and electrical connections and relocation as required to accomplish the above. Obtain approval in writing as to date, time, and location for shut-down of existing mechanical/electrical facilities or services.

3.16 START UP AND OWNER INSTRUCTIONS

A. Before acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct the Owners designated personnel on the proper operation and maintenance of systems and equipment. Obtain written acknowledgment from person instructed prior to acceptance repeat the instructions if asked to do so. Contractor is fully responsible for systems until acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. Provide, operating, maintenance and starting precautions and procedures to be followed by the Owner for operating systems and equipment. Mount the instruction in clear plastic holder on or adjacent to the equipment.

B. Where supervision by a manufacturer is called for, provide manufacturer’s certified technician or engineer to supervise the startup, testing and adjustment of the equipment or system. Where two or more manufacturers are involved (i.e., variable frequency drive and air handling unit) both manufacturer’s shall be present at start up. The manufacturer shall provide a written report detailing the testing and start-up including problems that occurred and their method of resolution.

C. The instruction shall include the following types of information:

1. System overview
2. Major component designation
3. System operation procedures
4. Maintenance scheduling and procedures
5. Provide a list of spare components each system would normally require

D. Services: Provide services required, for all equipment specified under this contract, for a period of (1) year after written acceptance by the Owner.

3.17 OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance Manuals. For projects containing multiple buildings, manuals shall be submitted separately for each building. Include the following:

1. As-Built drawings.
2. Equipment wiring diagrams.
3. Manufacturer's instructions.
4. Include typewritten instructions, describing equipment, starting/operating procedures, and emergency operating instructions.
5. Recommended maintenance procedures.
6. Include name, address, and telephone number of supplier manufacturer.
7. Representative and service agency for all major equipment items.
8. Panel schedules in hard copy and word or excel format.

9. Bind above items in a three ring binder with name of project on the cover.
10. Provide CD or DVD with all data in word, pdf, or excel format.

B. Refer to specific specification electrical specification sections for additional requirements.
C. Deliver to Owner's Representative before request for acceptance.

3.18 ASBESTOS RECOGNITION AND PRECAUTIONS

A. The contractor shall be responsible for coordination of all required removal work, coring, cutting and patching with the owners asbestos management plan. Prior to performing such work identify areas containing asbestos. Notify the Owner so that they may make arrangements for abatement and/or containment prior to work proceeding. The contractor shall be responsible for cleaning all areas where asbestos is released due to the failure to coordinate with the asbestos management plan. Refer to Division 1 sections for further requirements.

B. The disturbance or dislocation of asbestos-containing materials causes asbestos fibers to be released into the building's atmosphere, thereby creating a health hazard to workmen and building occupants. Consistent with Industrial Code Rule 56 and the content of recognized asbestos-control work, the Contractor shall apprise all of his workers, supervisory personnel, subcontractors, Owner and Consultants who will be at the job site of the seriousness of the hazard and of proper safeguards and work procedures which must be followed, as described in New York State Department of Labor Industrial Code Rule 56.

END OF SECTION

SECTION 260015 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Interior demolition, removal and abandonment of interior electrical systems including fire alarm.

B. Cleaning and repair of existing equipment to remain.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching work: As specified in individual sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning work inspect and test all existing electrical systems that will be affected by the work in this contract. Provide a report to the Owner indicating any problems or defects found. If no problems or system defects are submitted, the contractor shall be responsible for correcting problems found at the completion of the project that are determined to be caused by the work of this contract.

B. Inspect the entire work area for defects in the existing construction such as scratches, holes etc. Submit a complete list and photographs of existing damage, to the owner prior to beginning work. If existing damage is not documented the contractor shall repair all damage to like new condition, that is determined to have been caused by the work in this contract.

C. Verify circuiting arrangements are as shown on Drawings.

D. Verify that abandoned wiring and equipment serve only abandoned facilities.

E. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.

F. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with the owner and Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner and Architect/Engineer at least (72) hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer, and local fire service at least (72) hours before partially or completely disabling system. Minimize outage duration.

3.03 DEMOLITION EXISTING ELECTRICAL WORK

A. Demolish existing electrical work under provisions of Division 01, Division 02 and this section.

B. Remove existing installations to accommodate requirements for new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Provide blank cover for abandoned outlets which are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition work.

J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

K. Where branch circuit home run is called to be reused label circuit in junction box and remove all branch and switch leg wiring.

L. Where removal of branch circuit wiring effects devices or fixtures upstream or downstream, make permanent connections to maintain circuits. Existing circuits to must remain active. All required connections to maintain existing circuits must be made after normal hours and coordinated with the owner.

3.04 RESUPPORT OF DEVICES CONDUIT AND WIRING AFTER CEILING REMOVAL

A. Where existing ceilings are removed re-support all conduit 8 ft on center and all open cabling 4 foot on center.

B. Utilize open top cable hangers for supporting cables.

C. Where existing equipment, fixtures or devices are scheduled for reuse in new ceilings, remove and store in safe dry space. Make temporary connections to maintain through wiring where devices are removed.

3.05 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Use mild detergent to clean all exterior and interior surfaces; rinse with clean water, and wipe dry. Replace lamps and broken electrical parts.

END OF SECTION

SECTION 260016 - TEMPORARY ELECTRIC POWER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including the General and Supplementary conditions and Division 1 Specification Sections apply to the work of this Section.

1.02 SUBMITTALS

A. Not Required.

1.03 GENERAL REQUIREMENTS

A. Electrical Contractor shall furnish, install and maintain temporary electric system for lighting and power as described herein.

B. All temporary electric system work shall comply with all applicable OSHA Standards.

C. All temporary electric system work shall comply with all applicable N.E.C. Standards and local regulations.

D. Power shall be supplied from the source listed below.

E. Temporary service shall be installed on the jobsite where appropriate for the level of construction and as directed by Architect.

F. Temporary service and all devices and wiring shall be removed from the site when permanent facilities are available and as directed by Architect.

G. Temporary services including wire and cabling shall not interfere or impede movement of construction vehicles.

H. Contractor shall provide all maintenance necessary for continuous operation for temporary electric system throughout the duration of system operation.

I. Telephone service, or other connections, are not included in EC Contract, but the responsibility of the individual prime contractors.

PART 2 - PRODUCTS

None.

PART 3 - EXECUTION

3.01 TEMPORARY LIGHTING

A. Provide temporary branch circuits with weatherproof medium base lamp holders equipped with guards for lighting of 10 foot-candles in work area. Provide replacement lamps where required for the duration of system operation.

B. Provide temporary lighting in all work areas.

C. Provide temporary lighting for corridors, walk areas, stairs, etc. for safe entrance and egress.

D. Provide temporary lighting as required for security purposes for building exterior and applicable site locations and building interior locations.

E. Provide lighting in specific areas as directed by Architect.

F. Provide Temporary Lighting (Type F2) spaced 12’ on center and Emergency Lights (Type E1) spaced 40’ on center with Exit Signs (Type X1) at the end of each Corridor for Student Egress Tunnels at the High School. Refer to Construction Manager Staging Plans for additional information.

3.02 TEMPORARY CONVENIENCE POWER

A. Provide temporary convenience power distribution for the use of tradesman hand tools and other devices as requested by construction trades.

B. Branch circuits with GFCI type receptacle outlets for single phase 120-volt, 20-amp power.

C. Convenience power distribution shall cover all work areas of building within a 100' extension cord reach. Each contractor using power shall provide their own ground fault device protection.

3.03 TEMPORARY EQUIPMENT POWER

A. Provide temporary equipment power feeds for temporary heating equipment. Temporary heating equipment shall be furnished by others.

B. Branch circuits for heating equipment shall be connections with single phase 208-volt, 30-amp power. Coordinate exact locations with MC.

3.04 WIRE AND CABLES

A. Exterior Locations: Site wiring shall be by overhead methods where possible. Overhead wiring shall be a minimum of 18' above grade. For other locations, wiring shall be run underground in GRS conduit.

B. Interior Locations: Lighting circuits shall utilize suspended open type festoon style wiring. Power circuits shall be run flexible or rigid conduit as appropriate for each application.

END OF SECTION

SECTION 260190 - SUPPORTING DEVICES

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.03 REFERENCES

A. Refer to Division 1.

B. NECA Standard of Installation (National Electrical Contractors Association).

C. NFPA 70 - National Electrical Code.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 ANCHORING DEVICES

A. Sleeve Anchors (FS FF-S-325 Group II, Type 3, Class 3): Molly/Emhart's Parasleeve Series, Phillips' Red Head AN, HN, FS Series, or Ramset's Dynabolt Series.

B. Wedge Anchors (FS FF-S-325 Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly/Emhart's Parabolt Series, Phillips' Red Head WS, or Ramset's Trubolt Series.

C. Self-Drilling Anchors (FS FF-S-325 Group III, Type 1): Phillips' Red Head Series S or Ramset's Ram Drill Series.

D. Non-Drilling Anchors (FS FF-S-325 Group VIII, Type 1): Hilti's Drop-In Anchor Series, Phillips' Red Head J Series, or Ramset's Dynaset Series.

E. Stud Anchors (FS FF-S-325 Group VIII, Type 2): 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 Bolts: FS FF-B-561, square head type.
3. Machine Screws: FS FF-S-92, cadmium plated steel.
4. Machine Bolts: FS FF-B-584 heads; FF-N-836 nuts.
5. Wood Screws: FS FF-S-111 flat head carbon steel.
6. Plain Washers: FS FF-W-92, round, general assembly grade carbon steel.
7. Lock Washers: FS FF-W-84, helical spring type carbon steel.
8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required to sustain load.

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 HANGER RODS

A. Mid 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.

2.05 "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.

2.06 CHANNEL SUPPORT SYSTEM

A. Channel Material: 12 gage steel.

B. Finishes:

1. Phosphate and baked green enamel/epoxy.
2. Pre-galvanized.
3. Hot dipped galvanized.
4. 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. Grinnell 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).

2.07 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 Hollow Block or Tile Filled Concrete Deck:
   a) New Construction: Use cast-in-place concrete inserts by having Construction Work Contractor omitting blocks and pouring solid blocks with insert where required.

6. Attachment to Waffle Type Concrete Decks:
   a) New Construction:
      (1) Use cast-in-place concrete inserts in fresh concrete.
      (2) 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.

7. Attachment to Precast Concrete Planks: Use anchoring devices, except do not make attachments to precast concrete planks less than 2-3/4 inches thick.

8. 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.

9. 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 DIA.
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

      (1) Bottom chord of wood trusses may be utilized as structural support, but method of attachment must be specifically approved.
      (2) Do not make attachments to the diagonal or vertical members of wood trusses.
      (3) Do not make attachments to the nailing strips on top of steel beams.

10. 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 which 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 support fixtures from ceilings or ceiling supports unless it is specified or indicated on the drawings to do so.

1. 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.

2. 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.

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 Fixtures:
   a) Support individual fixtures less than 2 feet wide at 2 points.
   b) 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.
   c) Support individual fixture 2 feet or wider at 4 corners.
   d) Support continuous row of 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.

C. Number of Supports for Wall 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 Fixtures:
   a) Support individual fixtures 2 feet long or less at 2 points.
   b) Support individual fixtures over 2 feet long at 3 points.
   c) Support continuous row fluorescent fixtures at points equal to twice the number of fixtures. Uniformly distribute the points of support.
   d) An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.

2. Vandal Resistant, Fixtures:
   a) Support individual fluorescent fixtures 2 feet long or less at 4 points (each corner).
   b) Support individual fluorescent fixtures over 2 feet long at 6 points (each corner and midway along each side of longest axis).
   c) Support continuous row fluorescent fixtures at points equal to 6 times the number of fixtures. Uniformly distribute the points of support.
   d) An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.

3.06 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

SECTION 260195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.03 REFERENCES

A. Refer to Division 1.

B. NFPA 70 - National Electrical Code.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background

1. Locations:
   a) Outside of each electrical panel. Indicate panel name.
   b) Control equipment enclosure. Indicate equipment name and branch circuit.
   c) Disconnects Indicate equipment name and branch circuit.
   d) Distribution panel breakers. Indicate load served.

2. Letter Size: 1/8 inch letters.

B. Labels: Circuit designation shall be indicated with clear adhesive tape, 3/16 inch black letters on clear background. Use only for identification of individual wall switches and receptacles and control device stations. Tape label shall be adhered to the faceplate of each device.

C. Provide flash protection label per NEC 110.16 for equipment furnished under this Contract including switchboards, panelboards, industrial control panels and motor control centers. Seton #M0547; or equal.

D. Provide signage at service entrance disconnecting means indicating Emergency Generator that reads, “WARNING: A Emergency Generator is connected to this premises wiring system and is located in Area B near the Wood Shop.”

2.02 WIRE MARKERS

A. Description: Tape type wire markers.

B. Locations: Each conductor at panelboard gutters and each load connection.

C. Legend: Branch circuit or feeder number indicated.

2.03 UNDERGROUND WARNING TAPE

A. Location:

1. Along length of each underground conduit buried 12" below finished grade.

2. Detectable tape, 5.0 Mil. Overall Thickness, 0.80 Mil. Polypropylene Film Thickness, 0.35 Mil. Solid Aluminum Foil Core, 3.75 Mil. Polyethylene Film Thickness, Reverse Printed Polypropylene Structure, Diagonally Striped Design, Acid, Alkali, Chemical and Oil Resistant for the following:
   a) ELECTRIC: Yellow with black lettering that reads - "CAUTION – UNDERGROUND ELECTRIC".

3. Design Make: Pro-Line Safety Products.

2.04 PANEL SCHEDULES

A. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker.

B. Provide type written updated panelboard directories for existing panelboards affected by this work.

C. Panel directory must also include the up stream panel that services the panel. (i.e. "Fed from MDP Circuits 2,4,6")

D. Include a Microsoft word or excel file with all panel schedules as part of the close out submittals.

2.05 DEVICES

A. Provide a tape label on all receptacle and switch cover plates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to outside of receptacle or switch cover plates.

B. In permanent marker write the panel and circuit number on the wall behind receptacle cover plate or inside receptacle back box.

2.06 JUNCTION AND PULL BOXES

A. Identify junction and pullboxes for particular service such as power, lighting, fire alarm, telephone, intercom, public address, nurse call, etc. using stencil lettering on cover.

2.07 CONDUIT

A. Provide adhesive marking labels for raceway and metal-clad cable. The labels shall indicate voltage and service, and be located above ceilings every 75 feet and on wall mounted conduit in mechanical and equipment rooms.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using adhesive.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION

SECTION 260519 - WIRE AND CABLE (600 V AND BELOW)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 WORK INCLUDED

A. Conductors.

B. MC Cable.

C. Terminations.

1.03 SUBMITTALS

A. Schedule of all wiring and cable usage.
B. Product data sheets for all wire and cable types.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Feeder, branch circuit and control wiring:

1. Annealed Copper, 98% conductivity.

2. Minimum wire size:
   a) #12 AWG for branch circuits
   b) #14 AWG for control and signal circuits

3. #8 AWG Wire and above shall be stranded.

4. 600 volt insulation for all wiring above 50 volts.

5. 300 volt insulation permitted for all wiring below 50 volts.

6. Thermal plastic with PVC insulation with nylon jacket, suitable for wet or dry locations, THHN/THWN 90 degree Celsius.

7. 90 degree C maximum operating temperature rating.

8. UL 83 Listed

B. Lighting fixture wire

1. FREP/CPE coated stranded copper,
2. Flame retardant EPR Insulation and CPE jacket.
3. UL 44 listed

C. Flexible cords and cables shall be Type "SO" or "SJO.

D. Color Coding:

1. All circuits shall be color coded according to the following schedule:

Voltage	A PHASE	B PHASE	C PHASE	NEUTRAL
208Y/120V, 3 Phase	Black	Red	Blue	White

*ALL GROUNDING CONDUCTORS SHALL BE GREEN

2. #6 AWG and smaller shall have insulation continuously colored as called for above.

3. #4 AWG and larger may by identified using a minimum 3" tape band.

4. Color code all conductors at all pullboxes, enclosures, and terminations.

5. Switched legs shall be identified with the same color insulation as the phase leg.

E. Acceptable manufacturers

1. Cablec
2. Southwire
3. Okonite
4. Rome Cable
5. Pirelli

2.02 TYPE MC METAL CLAD CABLE

A. Construction:

1. Stranded or solid copper conductors, each individually insulated, and enclosed in an armor of flexible metal tape.
2. Suitable for wet or dry locations.
3. Suitable for cable tray installations.
4. Do not install direct buried, in concrete, or in the presence of corrosive vapors.
5. Provide with separate integral grounding conductor.
6. Support every 6 feet.
7. Manufactured and installed in accordance with NEC Article 330
8. Make: Acceptable manufacturers:
   a) AFC
   b) Southwire
   c) United Copper Industries

2.03 METAL CLAD COMBINATION LIGHTING POWER AND CONTROL CABLE.

A. Cable Shall have following construction

1. Armor: Galvanized Interlocking Steel Strip (blue armor) or Interlocking Aluminum Strip
2. Solid or Stranded Copper Conductors
3. Insulated Conductor Type THHN
4. Neutral Conductor: White or Gray
5. Control Cables: 16 AWG Solid TFN Twisted jacketed pair (Purple/Gray)
6. Insulation Permitting conductors of control circuits to be placed in a cable with conductors of electric light, power, or Class 1 circuits

B. Standards

1. UL 66, 83, 1479, 1569, 1581, 2556,File Reference E80042

2. NEC 250.118, 300.22(C), 392, 396, 330, 501, 502,503, 530, 504, 505, 518, 520, 530, 645, 725
3. Federal Specification A-A-59544 (formerly J-C-30B)
4. Meets all applicable OSHA and HUD Requirements
5. Cable Tray Rated
6. UL Classified 1, 2, and 3 hour through penetration (Fire Stop) product, R 14141
7. Environmental Air-Handling Space Installation per NEC 300.22(C)
8. Power and/or lighting as well as signal and/or control conductors per NEC Section 725.136(I)(1)

C. Design Make: AFC MC Tuff Luminary Cable

2.04 LOW VOLTAGE CONNECTORS AND TERMINATIONS

A. Straight Splices, #26 AWG To #10 AWG

1. Nylon Insulated compression butt-splices.
2. 600 volt, 90 degree C rated.
3. Make: Burndy "Insulink", T&B "Sta-Kon", or approved equal

B. Straight Splices, #8 AWG and Larger:

1. Two way, long barrel, compression type, copper
2. Provide heat shrink tubing over splice.
3. 600 volt rated.
4. Make: Burndy "Hylink", T&N 54800 Series, or approved equal.

C. Pigtail Splices, #26 AWG to #10 AWG:

1. Twist type pressure connector.
2. 600 volt rated, 105 degree C.
3. Size as required for number and size of conductors used.
4. Make: T&B Scotchlock, or approved equal

D. Three Way Splices, #8 AWG and Larger:

1. Three way, long barrel, compression type, copper.
2. Provide tape or heat shrink tubing over splice.
3. 600 volt rated.
4. Make: Burndy "Hylink", T&B 54700 Series, or approved equal.

E. Lug Terminations for Control and Signal Wiring:

1. Nylon insulated fork with compression termination of #26 AWG to #10 AWG.
2. Nylon insulated ring with compression termination for #8 AWG and larger.
3. 300 volt rated.
4. Make: Burndy "Insulug", T&B "Sta-Kon", or approved equal.

F. Lug Terminations for Power Wiring:

1. Long barrel, compression type, copper body, on hole for #8 AWG to #2/0 AWG.
2. Long barrel, compression type, copper body, two hole, for #3/0 AWG and larger.
3. 600 volt rated.
4. Make:
   a) One-hole lug: Burndy "Hylug", T&B 54900 Series, or approved equal.
   b) Two-hole lug: Burndy "Hylug", T&B 54800 Series, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Route wire and cable as required to meet Project Conditions.

B. Install cable in accordance with the NECA "Standard of Installation."

C. Use stranded conductors for control circuits.

D. Use conductor not smaller than 12 AWG for power and lighting circuits.

E. Use conductor not smaller than 16 AWG for control circuits.

F. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet.

G. Identify and color code wire and cable under provisions of this section. Identify each conductor with its circuit number or other designation indicated.

H. Install cables in raceway as called for after the entire raceway system has been completed.

I. Install splices and connections in accessible outlet, pull, and junction boxes.

J. Insulate all splices and connections with UL Labeled plastic tape, heat shrink tubing, or plastic molded caps.

K. All wiring systems shall be properly grounded and continuously polarized throughout, following the color coding specified.

L. Provide a green equipment ground with all feeders and all branch circuits' size per the NEC.

M. Provide dedicated white insulated neutral conductor for each branch circuit. Shared neutrals are not allowed.

N. Install a maximum of three phase conductors, three neutral conductors, and one grounding conductor in each home run. (Obtain approval for additional conductor fill where field conditions require. Adhere to NEC de-rating requirements.)

O. Provide stranded wire to motors, transformers, equipment, and vibrating machinery.

P. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner's Representative and receive written approval for splicing prior to installation of feeder(s). Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors.

Q. Use pulling means including fish tape, cable, and rope and basket type grips which will not damage cables or raceways. Use approved mechanical pullers for feeders and branch circuits as required for #6 AWG cable and larger. Do not use mechanical means to pull conductors No. 8 or smaller.

R. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equivalent.

S. Reconnect branch circuit wiring at panelboards as required to obtain a balanced three phase load on the feeders.

T. Properly splice and neatly coil extraneous wires in outlet boxes.

U. Wiring in panelboards and equipment enclosures etc. shall be neatly trained and arranged so as not to preclude access to the space or equipment contained therein. Provide all additional cable supports and ties required to comply.

V. The system shall be properly grounded and continuously polarized throughout, following the color coding specified.

W. Wiring within panelboards, control cabinets, pull boxes, wiring troughs and annunciator and/or alarm panels shall be neatly bundled together with ties not requiring tools to install. Two, three and four wire circuits emerging from the bundle shall be trained and tied individually.

X. Where multiple conductors are installed in a common raceway they shall be pulled simultaneously. Use of pulling compound or lubricant shall be avoided unless absolutely necessary. Where pulling lubricant is required, use UL approved compounds approved for cable type. Lubricant shall meet all OSHA and Toxic Control Act standards.

APPLICATION	CABLE TYPES	DESIGN MAKE
General purpose Construction & Maintenance	Rubber, Neoprene, Nylon, PVC, High Density XLP, Hypalon	Ideal - Yellow 77
High Temperature Construction & Maintenance	Rubber, Neoprene, Nylon, PVC, High Density XLP, Hypalon, Low Density Polyethylene, Semiconducting Jacket	Ideal - Yellow 190
Utility construction & Maintenance	Rubber, Neoprene, Nylon, PVC, High Density XLP, Hypalon, Low Density Polyethylene, Semiconducting Jacket	Aqua-Gell II
Cold Weather Construction & Maintenance	Rubber, Neoprene, Nylon PVC, High Density XLP, Hypalon, Low Density Polyethylene, Semiconducting Jacket	Aqua-Gel CW

3.02 CIRCUITING

A. The following takes precedence over the drawings:

1. General purpose receptacle and lighting branch circuits may be combined in single conduits in accordance with NEC requirements and restrictions.
2. Conductors serving individual pieces of equipment or grouped equipment or isolated ground branch circuits shall not be combined.
3. Provide dedicated Neutrals.

3.03 SPLICES

A. Dry locations: For conductors #10 AWG and smaller use standard spring type pressure connectors or compression type connectors with insulating jackets.

B. For conductors #8 AWG and larger use compression type connectors and insulate in accordance with manufacturer's recommendations.

C. Damp locations: Use same type splices as indicated for dry locations and wrap with moisture sealing tape.

D. Wire runs shall be continuous. All splicing shall be done only in accessible boxes.

3.04 LOW VOLTAGE CONTROL WIRING

A. Low voltage control wiring shall not be run in same conduit system as power feeds. All low voltage control wiring in equipment shall be neatly bundled, identified and installed remote from any and all mechanical moving parts. All low voltage control wiring in walls shall be installed in conduit, the same as required for power wiring. All low voltage wiring above inaccessible ceilings shall be installed in conduit. All low voltage wiring exposed in finished spaces shall be installed in wiremold surface raceway. All low voltage wiring exposed in unfinished spaces shall be installed in conduit. All low voltage control wiring above accessible ceilings shall be bundled, neatly run at right angles and/or parallel to building steel, tied to steel as high as possible with no more than 3" sags; wire may not be laid on ceiling framing or supported by ceiling framing. Low voltage wiring shall not be run between decking flutes or above structural members.

3.05 TYPE MC METAL CLAD CABLE

A. MC Cable shall be permitted for up to 6' fixture whips from junction boxes above drop ceiling areas to recessed light fixtures.

B. MC Cable shall be permissible for up to 10 ft drop from junction box to outlets in walls. MC Cable shall be permitted for horizontal cabling in drywall partitions.

C. Type MC Cable shall not be used for feeders or branch circuit home runs to panelboards.

D. Support cable at intervals not exceeding 4 feet.

E. Bending radius shall comply with Article 330.24 of the NEC.

F. Provide insulating bushing at all termination points between the metal sheath and outlet or junction box.

G. Type MC Cable shall not be installed exposed with the exception of fixture drops in mechanical or equipment rooms. Secure the cable to fixture hangers using nylon or plastic ties.

END OF SECTION

SECTION 260533 - CONDUIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 WORK INCLUDED

A. Metal conduit.
B. Liquid tight flexible metal conduit.
C. Electrical metallic tubing.
D. Non-metallic conduit.
E. Electrical non-metallic tubing.
F. Flexible metal conduit.
G. Fittings and conduit bodies.

1.03 SUBMITTALS

A. Submit for approval a list of each product and the manufacturer.

1.04 REFERENCES

A. ANSI-C80.2, 1983: Specification for Rigid Steel Conduit, Enameled.

B. ANSI C80.3: Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. NECA "Standard of Installation."

E. NEMA TC 2: Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

F. NEMA TC 3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.

G. NEMA, RN1, 1986: PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

H. NEMA, TC 6, 1983: PVC and ABS Plastic Utilities Duct for Underground Installations.

I. NEMA, TC 8, 1983: Extra strength PVC Plastic Utilities Duct for Underground Installations.

J. NEMA, TC 9, 1983: Fittings for ABS and PVC Plastic Utilities Duct and Fittings for Underground Installation.

K. NEMA, TC 10, 1983: PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.

L. The following U.L. Standards:

1. UL 1, 1985: Flexible Metal Electrical Conduit.
2. UL 3, 1984: Flexible Nonmetallic Tubing for Electric Wiring.
3. UL 6, 1981: Rigid Metal Electrical Conduit.
4. UL 360, 1986: Liquidtight Flexible Steel Conduit, Electrical.
5. UL 514B, 1982: Fittings for Conduit and Outlet Boxes.

6. UL 651, 1981: Schedule 40 and 80 PVC Conduit.
7. UL 797, 1983: Electrical Metallic Tubing.
8. UL 870, 1985: Electrical Wireways, Auxiliary Gutters and Associated Fittings.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4" unless otherwise specified.

B. Underground Installations:

1. Use thickwall non-metallic conduit.
2. Under Slab on Grade: Use thickwall non-metallic conduit.
3. Minimum Size: 1".

C. Outdoor Locations, Above Grade: Use rigid steel conduit.

D. In Slabs Above Grade:

1. Use rigid steel conduit or intermediate metal conduit.

E. Indoor:

1. Concealed: Use electrical metallic tubing.
2. Exposed: Use EMT unless otherwise called for.

2.02 RIGID GALVANIZED STEEL CONDUIT

A. 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).

B. Acceptable manufacturers:

1. LTV Steel
2. Triangle
3. Allied Tube
4. Steel Duct
5. Wheatland

2.03 ELECTRICAL METALLIC TUBING

A. 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).

B. Acceptable manufacturers:

1. Triangle
2. Wheatland
3. Allied Tube
4. Steel Duct
5. LTV Steel

2.04 FLEXIBLE METAL CONDUIT

A. Flexible Metal Conduit shall be constructed of one continuous length of spirally wound, interlocked, zinc coated strip steel. Interior surface shall be free from burrs or sharp edges. UL categorized as Flexible Metal Conduit (identified on UL Listing Mark as Flexible Steel Conduit or Flexible Steel Conduit Type RW).

B. Acceptable manufacturers:

1. Anaconda
2. American Flexible Conduit Co.
3. O-Z/Gedney
4. Thomas and Betts

2.05 LIQUID TIGHT FLEXIBLE METAL CONDUIT

A. Flexible Metal Conduit shall be constructed of one continuous length of spirally wound, interlocking zinc coated strip steel. Interior surfaces shall be free from burrs and sharp edges. Provide with a liquid-tight jacket of flexible polyvinyl chloride (PVC). 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).

B. Acceptable manufacturers:

1. Allied
2. American Flexible Conduit
3. Carlon
4. Thomas and Betts

2.06 RIGID NON-METALLIC PVC CONDUIT

A. Heavy wall conduit: Schedule 80, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground use.

B. UL categorized as Rigid Nonmetallic, 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).

C. Acceptable manufacturers:

1. Carlon/Div. of Lamson and Sessions
2. Beck Mfg./Picoma Industries
3. Cantex Inc.
4. National Pipe & Plastics Inc.
5. Ipex Inc.

2.07 FITTINGS AND ACCESSORIES

A. Rigid galvanized steel fittings shall be fully threaded and shall be of the same material as the respective raceway system.

B. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2" and double screw indenter fittings for conduits 2" and larger.

C. Fittings for flexible metal conduit shall be center stopped, insulated throat, U.L. E-11852 listed.

D. Fittings for liquidtight flexible metal conduit shall have zinc plated steel ferrule, compression type with sealing ring.

E. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.

F. Fittings for PVC coated rigid galvanized steel conduit shall be threaded, hot dipped galvanized, and coated inside and outside with a urethane coating.

G. Connectors shall have insulated throat up to and including 1" size. For sizes 1-1/4" and larger, provide plastic insulating bushing.

H. Die-cast or pressure cast fittings are not permitted.

I. Provide conduit bodies' types, shapes and sizes as required to suit application and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.

J. 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.

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.

K. Plastic Bushings for 1/2 and 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.

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.

L. 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.

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 3870.

M. 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.

N. Vertical Conductor Supports: Kellems/Hubbell Inc.'s Conduit Riser Grips, or OZ/Gedney Co.'s Type M, Type R.

O. 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.

P. Acceptable manufacturers:

1. O.Z. Gedney
2. Steel City
3. Thomas & Betts
4. Cooper Crouse-Hinds
5. Carlon
6. Raco

2.08 EXPANSION FITTINGS

A. Galvanized steel expansion joints for RGS or EMT conduit, PVC for PVC conduit. Minimum 4" movement in either direction.

B. Weatherproof for outdoor applications.

C. At expansion joints in concrete pours, provide Deflection/Expansion fittings capable of movement of 3/4" in all directions from the normal**.**

D. Design Make: O.Z./Gedney, Type "AX" (exposed), "DX" (Concrete Pour)

E. Acceptable manufacturers:

1. O.Z./Gedney
2. Crouse-Hinds
3. Appleton

PART 3 - EXECUTION

3.01 GENERAL

A. Install conduit in accordance with NECA "Standard of Installation".

B. PVC conduit is not permitted in any interior location within a school.

C. All conduit penetrations through fire-rated construction must be sealed with UL listed fire stopping. Refer to architectural drawings for locations.

D. Size raceways as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, type and insulation of conductors to be installed.

E. Minimum 3/4" trade size for branch circuit and fire alarm wiring.

F. Minimum 3/4" trade size for voice/data outlets, television outlets, and branch circuit "Home Runs" to panelboards.

G. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25% additional conduits.

H. Provide a code compliant ground path between all outlets and the established electrical system ground.

I. Coordinate all raceway runs with other trades.

J. Do not install raceways adjacent to hot surfaces or in wet areas. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104° F (40° C).

K. Provide expansion fittings with external grounding straps at building expansion joints.

L. Arrange neatly to permit access to the raceway, outlet, pull, and junction boxes, and work installed by other trades.

M. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.

N. All exposed conduit mounted to a painted surface shall be painted to match that surface.

O. No conduit shall be run in or through a Stairwell, Elevator Machine Room, hoist way or pit unless it contains circuitry specifically required for the Stairwell, Elevator or Elevator related equipment.

P. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Q. Provide at least one junction or pull box for each 360 degrees of bends.

R. Provide green ground wire in all EMT, flexible conduit, and non-metallic conduit.

3.02 INSTALLATION

A. Install raceways parallel or perpendicular to building walls, floors and ceilings.

B. Cut raceways square, ream ends to remove burrs, and bush where necessary.

C. Route conduit in and under slab from point to point. Do not cross conduits in slab. Provide U.L. approved rain-tight and concrete tight couplings and connectors. All conduit in concrete floor slabs shall be rigid galvanized steel with concrete tight threaded fittings. Install conduit below the reinforcing mesh. Locate conduits to provide a minimum of 1" of concrete around conduit. Obtain approval from the Owner's Representative prior to installing conduit larger than 1" trade size in concrete slabs.

D. Install with a minimum of bends and offsets. Bends shall not kink or destroying the interior cross section of the raceway. Factory made bends shall be used for raceways 1" trade size and larger.

E. Support raceways from building construction. Do not support raceways from ductwork, piping, or equipment hangers. Arrange supports to prevent misalignment during wiring installation. Support conduit using coated steel or malleable iron straps, lay in adjustable hangers, clevis hangers, and split hangers. Do not attach conduit to ceiling support wires. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

F. Plug the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.

G. Secure conduit within three feet of each outlet box, junction box, cabinet or fitting.

H. Provide a #14 AWG fish wire in all "Spare" or "Empty" conduit runs to facilitate future installation of conductors.

I. Provide expansion fittings where conduits cross building expansion joints.

J. Wherever a cluster of (4) or more conduits rise out of floor exposed, provide neatly formed 4 in. high concrete envelope, with chamfered edges, around raceways.

K. Provide 4 spare 3/4-in. raceways from each flush mounted panelboard or cabinet to an area above the nearest accessible ceiling space. Make 90º turn above the ceiling, arranged for further continuation of raceway, and cap.

L. Join non-metallic conduit using cement as recommended by manufacturer. Wipe non-metallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

M. Where conduits puncture roof, install pitch pockets as required in order that the roof warranty is maintained.

N. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.

O. Core drill, sleeve, and fire stop all penetrations through existing floors.

P. In exterior or wet locations, provide minimum 1/4" air space between raceway and wall. Secure raceway within 3 ft. of each outlet box, junction box, cabinet or fitting.

Q. Provide conduit supports based on the following table:

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
1/2", 3/4"	Concealed	7	10
1", 1-1/4"	Concealed	8	10
1-1/2" & larger	Concealed	10	10
1/2", 3/4"	Exposed	5	7
1", 1-1/4"	Exposed	7	8
1-1/2" & larger	Exposed	10	10

R. Conceal conduits in all locations except for mechanical and equipment rooms. Obtain owner's permission to run exposed conduits in other areas if existing conditions warrant exposed conduit.

3.03 REUSE OF EXISTING RACEWAYS

A. 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:

B. The existing raceway must be of adequate size for the new conductors to be installed therein (NFPA 70 Chapter 9, Tables 1, 4, & 5; Appendix 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.

C. Remove existing conductors.

D. Demonstrate to the Director's Representative that the existing raceway is clear of obstructions and in good condition.

E. 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.

F. Install insulated bushings to replace damaged or missing bushings. Replace non-insulated bushings with insulated bushings on raceway sizes 1 inch and larger.

G. Install vertical conductor supports to replace existing or missing vertical conductor supports.

H. Install extension rings on existing boxes when the number of new conductors installed therein exceeds NFPA 70 requirements.

I. Furnish the Owners' 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.

3.04 RACEWAYS FOR FUTURE USE (SPARE RACEWAYS AND EMPTY RACEWAYS)

A. Draw fish tape through raceways in the presence of the Owners Representative to show that the raceway is clear of obstructions. Leave a pulling-in line in each spare and empty raceway.

3.05 RACEWAY SCHEDULE

A. Electrical Metallic Tubing:

1. May be installed concealed as branch circuit conduits above suspended ceilings where conduit does not support fixtures or other equipment.

2. May be installed concealed as 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.

B. 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).

C. 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).

3.06 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, and 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.

9. Plastic bushing may be used on 1/2 and 3/4 inch conduit in lieu of insulated bushing.

10. Terminate conduit ends within cabinet/box at the same level.

B. For Rigid and Intermediate 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: Use conduit manufacturer's standard fittings and accessories.

END OF SECTION

SECTION 260534 - SURFACE RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Surface metal raceways.

B. Wireways.

1.03 REFERENCES

A. NECA (National Electrical Contractors Association) Standard of Installation.

B. NEMA WD 6 - Wiring Device Configurations.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum (3) years' experience.

PART 2 - PRODUCTS

2.01 SURFACE METALLIC RACEWAY

A. Combination Power and Data Cables:

1. 1.75" H x 4.75"W.
2. Metallic two piece raceway with single or split compartment as called for on plans.
3. Color shall be Ivory color durable finish scratch-resistant surface that can be painted.
4. Provide the following fittings:
   a) Entrance End Fitting: nominal maximum dimensions of 4.75"W x 3"H x 4"L and 2.5" or 2" conduit openings
   b) Back Entrance End Fitting: same as entrance end fitting with internal radius.
   c) T fittings.
   d) Flat internal and external elbows with fiber optic radius.
5. Design Make: Mono-Systems SMS4200 series raceway, with SMS4205 SMS4214FO, SMS4211FO and SMS4209FO fittings
6. Acceptable Manufacturers:
   a) Mono-Systems SMS4200 Series.
   b) Wiremold 4000 Series.

B. Single Branch Circuit or Data Cable

1. One-piece raceway
2. Color shall be Ivory
3. Utilized for wall mounted phones and miscellaneous branch circuit power only.

4. Provide internal and external 90 degree fittings with radius.
5. Design Make: Mono Systems SMS700
6. Acceptable Manufacturers:
   a) Mono-Systems SMS700 Series.
   b) Wiremold 700 Series.

C. Provide miscellaneous boxes, extension rings, fittings and supports designed and manufactured by the raceway manufacturer as required making a complete job.

2.02 WIREWAY

A. Manufacturers

1. Square D.
2. Substitutions: Refer to Division 1.

B. Description: General purpose, Oil-tight, dust-tight, and Rain-tight type wireway.
C. Knockouts: Manufacturer's standard.
D. Size: As indicated on Drawings.
E. Cover: Hinged cover.
F. Connector: Flanged.
G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
H. Finish: Rust inhibiting primer coating with gray enamel finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Support with expansion anchors, concrete inserts, masonry inserts or toggle bolts as field conditions require. Provide supports at five foot centers.

B. Install a separate green ground conductor in raceway from the junction box where surface raceway begins to the ground terminal of the device, fixture or equipment being supplied.

C. Provide all fittings, connectors, elbows, tees, boxes etc. as required for the installation.

D. Submit factory drawings detailing the installation. Include a complete part list.

E. Raceway shall be factory painted. Touch up raceway and outlet boxes as required upon completion of installation.

F. Provide new covers and device brackets in areas where existing raceway is called for reuse. Paint raceway to match existing upon completion.

G. Provide all required conduit entrance end fittings and elbows required for a complete installation.

H. Raceway shown on plans is diagrammatical only. Route raceway around existing room features as required.

I. Where existing conduits, pipes and other obstacles interfere with the installation of new raceway at 90 degree angles, provide bridge fittings to traverse the obstacle without rerouting. If this is not possible reroute the surface raceway or the existing raceway as directed by owners' representative.

J. Install Products in accordance with manufacturer's instructions.

K. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level. This shall be done for WM400BAC as well, even though raceway comes with adhesive.

L. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

M. Wireway Supports: Provide steel channel as specified in section 260190.

N. Close ends of wireway and unused conduit openings.

O. Ground and bond under provisions of section 260526.

END OF SECTION

SECTION 262400 - POWER DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Circuit Breakers.
B. Branch Circuit Panelboards.
C. Disconnect Switches.
D. Low Voltage Fuses.

1.03 REFERENCES

A. The equipment referenced herein are designed and manufactured according to the following appropriate specifications.

1. ANSI/NFPA70 - National Electric Code (NEC).
2. ANSI/IEEE C12.1 - Code for Electricity Metering.
3. ANSI C39.1 - Electrical Analog Indicating Instruments.
4. ANSI C57.13 - Instrument Transformers.
5. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
6. NEMA KS 1 - Enclosed Switches.
7. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681.
8. NEMA PB 2.1 - Proper Handling, Installation, Operation & Maintenance of Deadfront Switchboards Rated 600V or Less.
9. NEMA PB 2.2 - Application Guide for Ground Fault Protective Devices for Equipment.
10. UL 50 - Cabinets and Boxes.
11. UL 98 - Enclosed and Deadfront Switches.
12. UL 489 - Molded Case Circuit Breakers.
13. UL 891 - Dead Front Switchboards.
14. UL 943 - Ground Fault Circuit Interrupters.
15. UL 1053 - Ground Fault Sensing and Relaying Equipment.
16. UL 977 - Fused Power Circuit Devices.
17. CSA 22.2 No. 5 - M1986 Molded Case Circuit Breakers.
18. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.
19. Federal Specification W-C-870 - Fuseholders (for plug and enclosed cartridge fuses).
20. Federal Specification W-S-865 - Enclosed Knife Switch.
21. NECA Standard of Installation (published by the National Electrical Contractors Association).
22. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
23. NFPA 70 - National Electrical Code.

1.04 SUBMITTAL FOR REVIEW

A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

1.05 SUBMITTALS FOR CLOSEOUT

A. Maintenance Data: Include spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum (10) years' experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products in conformance with manufacturer's recommended practices as outline in applicable Installation and Maintenance Manuals.

B. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Inspect and report concealed damage to carrier within their required time period.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 CIRCUIT BREAKERS

A. General:

1. Molded case circuit breakers shall be constructed of a glass reinforced insulating material. All current carrying components shall be completely insulated and isolated from the outside of the circuit breaker.

2. Provide an over-center, trip-free handle to provide quick-make, quick-break contact action.

3. Provide multi-pole breakers with common trip.

4. When the circuit breaker has tripped, the handle shall move to a position between the "on" and "off" positions. Provide a visual indication that the circuit breaker has tripped.

5. The ampere rating shall be clearly marked on the face of the circuit breaker.

6. Make provisions to add circuit breaker handle locks.

7. Circuit breakers shall have voltage, ampere, and interrupting ratings as called for on the Panelboard Schedule.

8. Where the highest continuous current trip setting is or can be adjusted to1200A or higher Reduced Energy Let-through setting (RELT) is required.

B. Thermal Magnetic Molded Case Branch Circuit Breakers:

1. Permanent trip unit containing individual thermal and magnetic trip elements.
2. Thermal trip unit shall be long time, non-adjustable, thermal overload trip.
3. Magnetic trip unit shall be instantaneous, electro-magnetic trip. Magnetic trip unit shall be adjustable for all frame sizes 225 amperes and larger.
4. Interchangeable rating plugs shall be provided for all frame sizes 400 amperes and larger.
5. 60°C terminal temperature rating for circuit breakers rated 125 amperes or below.
6. 75°C terminal temperature rating for circuit breakers rated above 125 amperes.
7. All 20 and 30 ampere, single pole circuit breakers shall be UL listed for switching duty.
8. Circuit breakers shall be plug-on [bolt-on]. I-Line type distribution circuit breakers are acceptable.
9. Circuit breakers rated 250 amperes and below shall be UL listed HACR type.
10. Where ground fault circuit breakers are required, provide a shunt trip circuit breaker with a zero sequence sensing ground fault module.
11. Design Make: Square D QO, QOB (250 volt), EH, EHB (480 volt), I-Line style (600 volt).
12. Acceptable Manufacturers:
    a) Square D.
    b) General Electric.
    c) Cutler Hammer/Eaton
    d) Siemens

2.02 240 VOLT BRANCH CIRCUIT PANELBOARDS

A. 240 Volt rated, maximum 400 amperes.

B. 3 Phase, 4 wire or 1 phase, 3 Wire as called for on panel schedule.

C. Copper bus bars with high dielectric thermoplastic insulators.

D. Provide continuous current ratings, short circuit current ratings, branch circuit breakers, main circuit breaker or main lugs, and flush or surface trims as called for on the Panelboard schedule.

E. Provide nameplate on each panelboard indicating voltage, current, phase, wire, and short circuit rating.

F. 100 % rated neutral of the same material as the main bus.

G. Provide ground bus of the same material as the main bus.

H. Interior trim shall be dead front construction, with pre-formed metal twist-outs covering unused mounting space.

I. Enclosures shall be nominal 20" wide by 6" deep, galvanized steel construction with removable endwalls and knockouts.

J. Fronts:

1. Surface or flush mounted as called for on the Panelboard Schedule.
2. ANSI 49 gray electrodeposited enamel.
3. Fronts shall be one piece with door, and hinged to the enclosure.
4. Provide cylindrical tumbler type lock with catch and spring loaded stainless steel door pull. All locks shall be keyed alike to match existing panelboards.
5. Provide a clear plastic directory card holder on the inside of the door.

K. Design Make: Square D "NQ".

L. Acceptable Manufacturers:

1. Square D "NQ".
2. General Electric "A" Series.
3. Eaton "PRL 1A".
4. Siemens "Sentron S1".

2.03 DISCONNECT SWITCHES

A. Three pole, single throw, or as called for on the drawings.

B. Quick-make, quick-break switch operating mechanism.

C. Heavy-duty, current rating as called for on the drawings, voltage rating as required by the equipment served.

D. All current carrying parts shall be plated to resist corrosion.

E. Lugs shall be removable and rated for 75°C temperature rating.

F. Switch blades shall be visible when the switch is in the open position and the door is open.

G. Switch shall be pad lockable in the OFF and ON positions.

H. Provide fusible switches with rejection type fuse holders and fuses as indicated on the plans or as per fed equipment requirements.

I. Provisions for a field installable electrical interlock. Refer to Electric Equipment and Control Schedule for additional information.

J. Provide external override mechanism to open the disconnect switch door without opening the disconnect switch.

K. Enclosure shall be steel with gray baked enamel paint.

L. Provide NEMA type enclosures as called for on the drawings.

M. NEMA type 1 enclosures shall be equipped with knockouts.

N. Design Make: Eaton.

O. Acceptable Manufacturers:

1. Square D.

2. General Electric.
3. Siemens.

2.04 LOW VOLTAGE FUSES

A. All fuses rated 600 volts and below shall be rejection type dual-element, time-delay type. Provide (1) complete set(s) of fuses for all fusible disconnect switches, plus (3) spare fuses of each size. Deliver spare fuses to the Owner and obtain receipt.

B. Acceptable manufacturers: Fuses 600 amperes and below: Bussman Type FRN-R (300 volts), Type FRS-R (600 volts) or equivalent.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment to coordinate with installation details of other equipment associated with the power distribution system.

B. Provide miscellaneous bolts, washers, nuts, clips, lock washers, small hardware, etc., of durium or equal rust resistant material, to make a complete installation.

C. Provide complete installation in strict accordance with the equipment manufacturer's instructions, drawings and recommendations and as called for.

D. In the event of conflict, discrepancy or difference between manufacturer's instructions and Contract Documents, the more stringent requirements shall apply.

E. Unload, move, handle, set in place, install, erect, assemble, connect, test, and operate, etc. all items of electrical equipment as required.

F. Provide rigging to unload, move, transport, set in place, erect, etc. the switchboards.

G. Provide grounding as called for.

H. Provide minimum working clearance as described in NEC Article 110-26 and 110-34 for all electric equipment.

I. Provide additional working or aisle clearance as called for.

J. Verify cable/lug sizes for terminations. Where a feeder is sized larger than the lug, provide in-line splice to reduce conductor size to match equipment or breaker terminations.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, and Section 7.5 for circuit breakers.

3.03 ADJUSTING

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Wall switches.
B. Occupancy Sensors.
C. Receptacles.
D. Cover Plates.
E. Hand Dryers.

1.03 REFERENCES

A. NECA - Standard of Installation.
B. NEMA WD 1 - General Requirements for Wiring Devices.
C. NEMA WD 6 - Wiring Device - Dimensional Requirements.
D. NFPA 70 - National Electrical Code.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum (3) years' experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 GENERAL

A. Color of devices shall be as selected by the Architect.

B. Where devices are added to existing facilities the color shall match other existing devices in the room or vicinity.

C. All devices must be specification grade at a minimum.

D. Where devices are ganged together provide multi-device cover plates configured as required.

E. Design Makes are from Pass & Seymour. Equivalent products from the following manufacturers are acceptable.

1. Hubbell.
2. Leviton.
3. Lutron.

2.02 DIMMERS

A. Line Voltage 0-10V Dimmer:

1. For use with 0-10V, 4 wire, 120V and 277V dimming ballasts and drivers.
2. For use with loads less than 10A/120V and 5A/277V.
3. Field configurable wall plate system.
4. Labeling system.
5. Adjustable low end output voltage.
6. Rugged slide-dimmer construction.
7. Minimum of de-rating when ganged.
8. Single pole slide-to-OFF and single pole/3-way as required.
9. Design Make:
   a) Wattstopper RH4FBL3P Series (Single Pole and 3-Way).

2.03 SPECIFICATION GRADE SWITCHES

A. Specification Grade one-piece brass alloy contact arm for reliable electrical performance.

B. One-piece steel strap with integral ground is plated for corrosion resistance.

C. High strength thermoplastic polycarbonate toggle resists breaking and chipping under heavy abuse.

D. Heavy-duty toggle bumpers for smooth and quiet operation.

E. Back body made of glass-reinforced nylon.

F. Locking support provides resistance to face and back body separation.

G. Available with side wire or external screw-pressure-plate back and side wire models capable of accepting #14 - #10 AWG copper or copper-clad wire.

H. Cam designed for fast make with positive break action to minimize arcing and prolong switch life.

I. Oversized silver alloy contacts for longer dependable switch life.

J. Provide double pole, single pole, three way or four way as called for or required.

K. 120/277V, 20 Ampere rated.

L. Design Make: Pass and Seymour CSB series.

2.04 OCCUPANCY SENSORS

A. Wall Switch Sensor:

1. Detection Signature Analysis for high immunity to RFI and EMI.
2. Compact, decorator design replaces existing wall switch.
3. Integrated light level sensor works from 10 to 150 foot-candles.
4. Compatible with all electronic and magnetic ballasts, PL lamp ballasts, compact fluorescent.
5. Adjustable time delay of 30 seconds to 30 minutes.
6. Dual 120/277VAC operation.
7. Positive detection indicator.
8. No minimum load requirement.
9. Adjustable sensitivity from 20% to 100%.

10. 180 degree coverage of up to 900 sq. ft.
11. 5-year warranty.
12. Design Make: Pass & Seymour WSP200 series

B. Ceiling Mounted Sensors:

1. Advanced signal processing circuitry helps to eliminate false ONs.
2. Utilizes advanced, omni-directional (360 degrees), Doppler technology for reliable occupancy detection.
3. Angled transmitter and receiver pairs help optimize sensitivity while eliminating unwanted detection from ceiling air movement.
4. Digital DIP switch time delay (15 seconds to 30 minutes).
5. LED indicates occupancy detection.
6. Reliable solid-state construction.
7. Temperature and humidity resistant 32 kHz receivers.
8. Mounts to ceiling tiles or box.
9. Units per power pack: up to 4.
10. UL listed.
11. 5-year warranty.
12. Design Make: Pass & Seymour;
    a) CSU600 (rooms less 500 square feet).
    b) CSU1100 (rooms 500-1000 square feet).
    c) CSU2200 (rooms 1000-2000sqare feet).

2.05 DUPLEX RECEPTACLES

A. Dual mechanical shutter system to help prevent insertions of foreign objects.

B. Two drive screws anchor strap to back body and face where abrupt removal torque is greatest.

C. 0.032-inch-thick brass triple-wipe power contacts for lasting retention.

D. Corrosion-resistant plated steel strap is locked in to the face and back body to resist pulling away from the face/body assembly.

E. Auto-ground clip for positive ground.

F. Easily accessed break-off line-contact connecting tab for fast and easy split-circuit wiring.

G. Backed-out tri-drive steel terminal screws.

H. Side wire capability.

I. Design Make: Pass & Seymour TR20 series.

2.06 GFCI RECEPTACLES

A. Dual mechanical shutter system to help prevent insertions of foreign objects.

B. 20 ampere rated.

C. No exposed terminals to a finger safe application before, during, and after installation.

D. Built-in connector features large brass terminal blades to ensure consistent, reliable electrical connections to Plug Connector.

E. Protection: if critical components are damaged and ground fault protection is lost, power to receptacle is disconnected.

F. Prevents line-load reversal miswire: no power to the face or downstream receptacles if wired incorrectly.

G. FSUL Listed (Federal Specification WC596).

H. Exceeds UL943 voltage surge requirements; survives 100x the required UL 3kA/6kV voltage surge test cycles.

I. Trip indicator light (red LED).

J. Mounting screws are shipped captive in the device and wall plate for easier installation.

K. High-impact-resistant thermoplastic construction.

L. Zinc-plated steel mounting strap.

M. Button colors matching the device face.

N. Dual-direction test and reset buttons.

O. Class A rated GFCI.

P. Design Make: Pass & Seymour 2097TRRI Series.

2.07 COVER PLATES

A. Stainless Steel Cover Plates:

1. Type 302 or 304, satin finish, 0.040" thick, accurately die cut, protected with release paper.
2. Flush mounting plates shall be beveled with smooth rolled outer edge.
3. Surface mounting plates shall be beveled and pressure formed for smooth edge to fit box.
4. Where two-gang boxes are required for single gang devices. Provide special plates with device opening in one gang and second gang blank.

B. Weatherproof Cover Plates:

1. Weatherproof plastic in-use cover
2. Horizontal/vertical cover in clear MM410C that safely covers any electrical outlet
3. Universal fit to enable same product for all types of receptacles.
4. Attached gasket and mounting hardware
5. Meet or exceeds OSHA and NEC (article 406.8[b][1] wet location requirements with the cord plugged into the receptacle.

2.08 HAND DRYERS

A. Meets 4” ADA protrusion guidelines.
B. Antimicrobial wall guards with brushed stainless steel.
C. 120V, 750-920W, 2.9-3.4A, 300-380W, 60Hz.
D. Selector switch to disable heating element.

1. Design Make: Excel Thin Air Hand Dryer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation verify that outlet boxes are cut in at proper height; that wall openings are neatly cut and will be completely covered by wall plates.

B. If wall openings were made by general trades notify that contractor and owners representative and direct the cutting and patching requirements. If the openings were made by electrical contractor cut and patch opening using a qualified trades person.

3.02 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on top.

G. Connect wiring device grounding terminal to outlet box with bonding jumper and to branch circuit equipment grounding conductor.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas and above accessible ceilings.

K. Install protective rings on active flush cover service fittings.

L. When receptacle is mounted horizontally, neutral pole shall be on top.

M. Provide extension rings to bring outlet boxes flush with finished surface.

N. Provide receptacles at locations indicated and where required by special equipment with plug connection. Mount at height 18" AFF; unless noted otherwise on drawings.

O. Receptacles shall not be installed back to back unless otherwise noted.

3.03 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test all receptacles for proper voltage, grounding and polarity.

E. Test all GFCI receptacles for proper voltage, polarity, grounding, and verify the receptacle trips at 6 milliamperes or less.

F. Test all receptacles for polarity, ground continuity and ground blade retention force per NFPA 99 Chapter 3-3 Section 3-3.3.3.

G. Rewire receptacles as required until receptacles test properly.

H. Clean exposed surfaces to remove splatters and restore finish.

3.04 FUNTIONAL TESTING

A. Where Dimmers, Occupancy Sensors, time switches, programmable schedule controls, photo sensors are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.

2. Confirm that the time switches and programmable schedule controls are programmable to turn the lights off.

3. Confirm that the placement and sensitivity adjustments for the photo sensor controls reduce electric light based on the amount of usable daylight in the space as specified.

B. Contractor shall submit a written report to Architect, copy to Engineer, on results of each functional test on equipment installed. Report shall contain owner's representative's signature.

3.05 SWITCHES

A. Provide switches to control outlets, appliances, lighting, etc. as indicated. Mount 48" above finished floor unless noted otherwise.

B. Do not feed thru local switches unless specifically noted.

C. Where more than one switch is indicated at one location on 120 volt circuits mount in gangs under common plate.

D. Locate switches on strike side of door. If switch is indicated at location which would be concealed (behind equipment, etc.) or not on strike side of door, obtain approval of Architect before installation.

E. Switches shall not be installed back to back unless otherwise noted.

3.06 DEVICE PLATES

A. Provide at locations indicated with size openings required for devices indicated.

3.07 WALL PLATES

A. Provide at locations indicated with size openings required for devices indicated.

B. Multi-gang switches, receptacles, etc. shall be in a common one piece plate.

END OF SECTION

SECTION 265010 - LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Interior luminaires and accessories.

B. LED drivers and light engines.

1.03 STANDARDS REFERENCES

A. Consortium for Energy Efficiency (CEE).

B. NYSERDA National Grid, NYSEG performance based rebate program.

C. NYSERDA National Grid pre-qualified rebate program.

D. Design Lighting Consortium (DLC).

E. Energy Star.

F. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub. No. LE-1 and LE-2 pertaining to lighting equipment.

G. ECCC of NYS Compliance: Comply with applicable requirements of the Energy Conservation Construction Code of NYS, Section 805.

H. ANSI 132.1.

I. UL Compliance: Provide lighting fixtures which have been UL listed and labeled.

J. FCC Part 15.

K. IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.

L. NFPA 70: National Electrical Code.

M. NFPA 101: Life Safety Code.

N. Testing Standards: IESLM79- 08.

O. UL1449 3rd Edition Type 4-Surge Protective Devices.

P. RoHS Compliant (Restriction of Use of Hazardous Substances).

1.04 SUBMITTALS FOR REVIEW

A. Product Data: Provide dimensions, ratings, and performance data. Information on each fixture shall include:

1. Manufacturer and Catalog Number.
2. Dimensioned Construction Drawing(s).

3. Standard Catalog "Cut" Sheet with options highlighted.
4. Photometric Data.
5. Driver specifications.
6. ES compliance.
7. DLC compliance.

B. Submit manufacturer's operation and maintenance instructions for each product.

1.05 QUALITY ASSURANCE

A. Lighting fixtures shall be standard products of manufacturers regularly engaged in the manufacture of the specific type lighting fixtures specified and shall be the manufacturer's latest standard design that complies with specification requirements. Firms installing the fixtures shall have a minimum of (5) years of successful installation experience on projects with interior lighting work similar to the requirements of this project.

B. Verify the availability of all fixtures proposed to be used in the execution of the work prior to submitting for approval. The discontinuance of production of any fixture after such approval has been granted shall not relieve the Contractor from furnishing an approved fixture of comparable quality and design at no additional cost.

C. Lighting fixtures shall be as specified in the "Luminaire Schedule." Fixture types, characteristics, photometrics, finishes, etc., correspond to the first manufacturer, and associated catalog number, listed in the "Luminaire Schedule." Provide a sample fixture from the factory for any products not listed as acceptable for approval. The Owner's Representative reserves the right to disapprove any fixture type submitted which is not equal in quality, appearance or performance to the fixture specified.

D. Drivers and LED boards: The manufacturer shall provide written warranty against defects in material or workmanship, including replacement, for five years from date of manufacture. Drivers and LED boards shall be manufactured in an ISO 9002 Certified Facility.

1.06 CONTROLS AND DRIVERS

A. The contractor shall provide all branch/switch circuit and control wiring the approved dimming controls.

B. Where alternate arrangements are proposed the contractor and his lighting representative shall be responsible for selecting and providing proper driver and dimming combinations subject to the following physical and performance criteria:

1. All fixtures must dim smoothly to a minimum of 10% of total lumen output with no visible flicker.

PART 2 - PRODUCTS

2.01 LUMINAIRES

A. Furnish Products from acceptable manufacturers listed in the light fixture schedule.

2.02 LED DRIVERS AND LIGHT ENGINES

A. Acceptable Manufacturers:

1. Philips.
2. Lutron.
3. Microsemi.
4. Approved Equal.

B. General Requirements:

1. The LED driver and board shall have a (5) year warranty.

2. LED lamps shall have a minimum rated life 50,000 hours.

3. LED driver board combinations shall deliver a minimum of 90 lumens/watt.

4. Shall be rated dual voltage 120/277V.

5. Must have surge suppression protection suitable for use in permanently connected products meeting UL1449 3rd Edition Type 4.

6. Must meet ANSI C62.41 Category A surge protection standards up to and including 4 kV.

7. Light engine shall provide 4,000K color temperature.

C. General LED Driver Requirements:

1. LED Driver shall be installed inside an electrical enclosure.

2. Wiring inside electrical enclosure shall have a 600V/105°C rating or higher.

3. Must tolerate sustained open circuit and short circuit output conditions without damage.

4. Maximum allowable case temperature of 70°C.

5. Must comply with the requirements of UL, FCC, ENEC, CE, CQC.

6. The input and output connections shall be factory wiring only. Connection to supply mains shall be determined in the end product.

7. Temperature tested in a 55°C ambient, with the maximum temperatures on the enclosure of 73.1°C.

8. Suitable for use in dry and damp locations.

9. Installed as a built-in component of the end product. The unit shall be installed in compliance with the enclosure, mounting, spacing, casualty, temperature, and segregation requirements of the end product application.

10. The transformer shall employ a Class 130(B) insulation system.

11. Spacing in accordance with the requirements of the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750, First Edition, Clause 7.8.3 and Table 7.4.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

B. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

C. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using existing hardware.

D. Install recessed luminaires to permit removal from below.

E. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.

F. Install clips to secure recessed grid-supported luminaires in place.

G. Install accessories furnished with each luminaire.

H. Connect luminaires, emergency lighting units, and exit signs to branch circuit outlets provided under section 260519 using flexible conduit.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install specified lamps in each exit sign, and luminaire.

K. General:

1. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's 'Standard of Installation'', NEMA standards, and with recognized industry practices.

2. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Engineer.

3. Make installation such that the fixture is free of finger marks, flaws, scratches, dents or other imperfections.

4. Arrangement:
   a) Align edges of fixtures with walls or other building elements. Where indicated by dimensions or indicated on drawings, maintain indicated arrangement.
   b) For wall to wall installed light fixtures, field measure length required after completion of the wall construction and prior to ordering the light fixtures. Fabricate in largest lengths allowable.

5. Recessed Mounting:
   a) Verify ceiling construction and material prior to ordering light fixtures. Provide plaster frames for plaster ceilings and flanged frames for drywall ceiling. Provide necessary mounting hardware and accessories to adapt fixture to ceiling construction. Provide gaskets, trims, flanges, etc. as required to prevent light leaks around trim. Where installing 'lay-in' type fixtures, provide galvanized supports to the building structure, independent of the ceiling system, at all four comers of the fixture. Each support shall be capable of supporting 100 pounds and each wire shall be a minimum of 12 AWG mild steel. Provide saddle hangers or tie bars attached to runners or between crossbars of ceiling systems as a safety measure. Provide mounting splines or other positive means of maintaining alignment and rigidity. Use a minimum of (2) supports independent of the ceiling for each point source type fixture.

6. Stem Mounting:
   a) Use self-aligning hangers in canopies for hanging fixtures true to vertical. Do not deface ceiling or walls. Locate hangers at intersections of joints or at centers of blocks in rooms with patterned type ceiling materials such as acoustic tile. Use hangers capable of supporting four times fixture weight. Align continuous rows of fixtures maintaining fixtures level without rotation about the longitudinal axis. Rigidly support outlet box independent of ceiling system from building structure. Where obstructions prevent direct support of outlet, provide offset or trapeze hangers of outlet box. Stem shall be supported directly from building structure on centers as called for by the manufacturer. There shall be a minimum of (2) stems per individual four foot light fixture, and (3) stems per individual eight foot light fixture for steel fixtures. Extruded aluminum fixtures shall have hangers as called for by the manufacturer.

7. Surface Ceiling Mounting:
   a) Mount surface fixtures tight to surface without distorting surface. Space fixtures in continuous rows to correspond to ceiling joint intersections. Continuous row fixtures may be fed by a single outlet where fixtures contain approved wireways and suitable wiring is used. Provide hangers for each fixture, each rated to support four times the fixture weight. Provide offset or trapeze hangers where required. Supports shall be provided on a maximum of 4 foot centers with a minimum of (2) hangers per individual four foot light fixture and (3) hangers per individual eight foot light fixture. Hangers shall be supported from the building structure and independently from ceiling system or other building services.
   b) Fasten fixtures securely to structural supports.

3.02 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

B. Examine areas and conditions, under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

C. Refer to respective reflected ceiling plan for each area. Reflected ceiling plans indicate proper light fixture location only. Coordinate the proper arrangement with all other ceiling mounted devices. Contract Documents indicate light fixture characteristics (type), quality, quantity, etc. Verify with the ceiling supplier design of actual ceiling installed in each area and coordinate compatible fixture flange.

3.04 ADJUSTING

A. Aim and adjust luminaires.
B. Position exit sign directional arrows as indicated.

3.05 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.
B. Remove dirt and debris from enclosures.
C. Clean photometric control surfaces as recommended by manufacturer.
D. Clean finishes and touch up damage.

3.06 REUSE AND REPAIR OF EXISTING LUMINAIRES

A. Reuse existing luminaires only where called for. Perform the following work, as required, to upgrade existing luminaire.

1. Replace faulty, leaking, or noisy ballast.
2. Replace broken, damaged, worn, or faulted lamp sockets.
3. Provide new fixture wire.
4. Provide new acrylic lens system to match existing, where existing is broken.
5. Re-lamp luminaires.
6. Completely damp clean lens and interior of luminaires.

B. If ballast has leaked, remove material deposited in fixture. Assume material was PCB contamination, or test samples to show material is not PCB and submit a report. Dispose of material as required by EPA, including clean-up materials used. Dispose of ballast which do not have non PCB label in PCB containers and have containers taken to EPA approved incinerators. Follow all EPA regulations for transporting material.

C. New fixtures may be provided to replace existing fixtures scheduled to remain or be reused, subject to shop drawing approval.

3.07 REMOVAL OF BALLAST IN EXISTING LIGHT FIXTURES

A. Assume ballast contain PCB materials unless labeled otherwise, or test samples to show materials are not PCB; submit test report. Remove all ballast from existing light fixtures indicated on contract documents. Dispose of all ballast which do not have non-PCB labels in PCB containers and pay all costs to have containers taken to EPA approved incinerators and disposed of per all EPA regulations. Follow all EPA regulations for transporting containers and materials. If ballast has leaked in existing fixture, remove material deposited in fixture and dispose of those material as listed above. Provide Certificate of Disposal and all associated paperwork to Owner's representative.

3.08 REMOVAL OF LAMPS IN EXISTING LIGHT FIXTURES

A. Assume all fluorescent lamps contain Mercury materials unless labeled otherwise, or test samples to show materials do not contain Mercury and submit test report. Remove all lamps from existing light fixtures indicated on contract documents. Dispose of all lamps which do not have non-Mercury labels in compliance with the requirements of the New York State Department of Environmental Conservation and all applicable Federal Laws. Follow all regulations for transporting materials. Provide Certificate of Disposal and all associated paperwork to Owner's representative.

END OF SECTION

SECTION 275116 – PUBLIC ADDRESS SYSTEM RENOVATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to work in this section.

1.02 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.03 GENERAL REQUIREMENTS

A. Provide modifications and wiring as required to connect to the Rauland Telecenter Public Address System (PA). Service provider – Open Systems (914) 241-0058.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

B. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

C. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years experience.

D. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.05 SYSTEM DESCRIPTION

A. Prior to beginning work, review the existing sequence of operation. The existing sequence of operation shall be maintained.

1.06 SUBMITTALS

A. Provide submittals for the entire system including:

1. Provide a complete system test report of the existing system by a technician certified by the system manufacturer. Submittal shall include report for owner’s reference.

2. Complete equipment list including quantities.
3. Riser Wiring Diagram showing all existing and new devices, wire quantities and sizes.

PART 2 - PRODUCTS

2.01 PUBLIC ADDRESS SYSTEM

A. Provide all modifications, wiring, splice boxes and additional expansion cards as required for a fully functional Public Address System.

B. Provide all programming as required for installation of new devices.

C. System circuits shall be configured to match existing system.

2.02 SPEAKERS

A. Speaker Baffle Ceiling: Flush mount ceiling baffle, 22 gauge cold-rolled steel with perforations for 8” speaker and deep edge radius. Baffle shall include (4) concealed welded studs for speaker mounting. Finish shall be zinc treated with white baked epoxy finish. Match existing manufacturer.

2.03 SPEAKER TAP SCHEDULE

A. Classroom: 1 watt
B. Gym: 6-8 watt
C. Exterior: 6-8 watt unless noted otherwise
D. Corridors: 2 watt

2.04 CABLE SCHEDULE

A. Belden Cable; or equal.
B. All devices shall be wired from endpoint directly back to equipment rack.
C. Wiring runs shall be continuous, splicing of sound system wire is not permitted.
D. Tape back all unused speaker wires, shields, and unused transformer tap pigtails.
E. Provide proper wiring to meet equipment requirements.
F. All conductors shall be min. 22 AWG stranded copper PVC jacket.
G. Speaker Only Circuits: (i.e.- corridor speakers)

1. (1) Twisted shielded pair (20 AWG)

H. Classroom:

1. (1) 3 conductor shielded to speaker (22 AWG)
   a) Three conductor, non-twisted, tinned copper, polyethylene insulated, 100% overall shield, gray PVC jacket, color coded black, and white. Cat. #8771, 22 gauge, stranded, 24 gauge drain wire size.

PART 3 - EXECUTION

3.01 GENERAL

A. Open wiring is permitted above corridors where ceiling are accessible using removable ceiling tiles. Provide conduit runouts from all outlets or wiring in non-accessible locations. Provide bushings on all conduit ends.

B. Support wiring from existing walls or ceilings using onidal rings spaced not more than 4'-0" apart. Cable laid on ceiling panels is not acceptable.

C. Wiring shall be in accordance with the recommendation of the existing sound system manufacturer.

D. Each cable shall be clearly labeled with factory printed panduit type wire markers for circuit wire number at both ends. Hand written tags will not be acceptable.

E. Each cable shall be continuous from the main control console to termination point, except where otherwise noted. Splices in wire or cable are allowed only where specifically noted.

F. Where it is impracticable to conceal conduit in finished spaces, cable shall be run in Wiremold.

3.02 TESTING

A. The entire Public-Address System shall be tested for audible clarity. Each speaker shall be adjusted to provide a clear audible level of sound in all areas of the space they are intended to cover. Any defective speaker shall be replaced. No audible static shall be present on any line.

B. Contractor is required to readjust speaker taps as dictated by job conditions and at request of Engineer.

C. Submit results on an approved test report form signed by the manufacturer's representative.

D. Certificate: The manufacturer’s representative shall examine this installation and certify that the system is properly installed and operating.

3.03 MANUFACTURER'S REPRESENTATIVE

A. Secure the services of the manufacturer's representative for a minimum of (3) working days (Not necessarily consecutive) for the following:

1. Supervision of system installation.
2. Supervise and witness the final system test.
3. Train facility personnel on the operation and maintenance of the system.

END OF SECTION

SECTION 283111 - FIRE ALARM SYSTEM RENOVATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.03 GENERAL REQUIREMENTS

A. Provide modifications and wiring as required to connect to the Edwards EST3 Fire Alarm Control Panel. Service provider – Open Systems (914) 241-0058.

B. Provide all equipment and accessories for a complete, electrically supervised, fire alarm system.

1.02 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years experience.

E. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.03 REFERENCES

A. Codes

1. The following Articles of the National Electric Code (NFPA 70)
   a. Article 760 - Fire Alarm Systems

2. The following National Fire Protection Agency (NFPA) standards:
   a. NFPA 72 - National Fire Alarm Code
   b. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
   c. NFPA 101 - Life Safety Code

3. The following U.L. Standards:
   a. UL 864/UOJZ,APOU - Control Units for Fire Protective Signaling Systems
   b. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
   c. UL 268A - Smoke Detectors for Duct Applications
   d. UL 521 - Heat Detectors for Fire Protective Signaling Systems
   e. UL 228 - Door Holders for Fire Protective Signaling Systems
   f. UL 464 - Audible Signaling Appliances
   g. UL 1638 - Visual Signaling Appliances

h. UL 38 - Manually Activated Signaling Boxes
i. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems
j. UL 1481 - Power Supplies for Fire Protective Signaling Systems

B. Building Code of New York State

C. Fire Code of New York State

1.04 SYSTEM DESCRIPTION

A. Prior to beginning work, review the existing sequence of operation. The existing sequence of operation shall be maintained.

B. All fire alarm pull stations and a/v units shall be red unless otherwise indicated including junction boxes, exposed back boxes, and cover plates.

C. Provide activation of necessary functions at the Fire Control Panel as directed by the particular elements in alarm or activated.

1.05 SUBMITTALS

A. Provide submittals for the entire system including:

1. Complete equipment list including quantities.
2. Calculations, including actual equipment loads used to derive battery backup ampere-hour rating.

PART 2 - PRODUCTS

2.01 FIRE ALARM CONTROL PANEL

A. Provide additional expansion cards in existing fire alarm control panel as required. Expansion cards shall be of the same manufacture as the existing panel.

B. Provide all programming as required for installation of new devices and expansion cards.

C. Provide additional NAC power supplies as required for additional notification device loads.

D. System circuits shall be configured to match existing system.

2.02 OUTPUT DEVICES AND RELAYS

A. Provide output relays to match devices. Field verify existing manufacturer and part numbers of devices prior to ordering.

B. Visual notification device layout is based on 100 Candela-Second Zenon flash output. Provide additional devices as required to meet NFPA requirements.

C. Audible notification device layout is based on a rated 104 dB at 10 ft. Provide additional devices as required to meet NFPA requirements.

2.03 FIRE ALARM CABLING

A. All wiring shall be twisted, copper. Wire must be certified for use by manufacturer. Wiring shall be sized as follows

1. Minimum #16 AWG for station circuits
2. Minimum #14 AWG for signal and detector circuits

3. Minimum #12 AWG for power supply circuits.
4. Provide large wire where required for voltage drop.

B. Wire must be plenum riser rated, red in color.

2.04 NOTOFICATION AND INNITIATION DEVICES

A. Match existing.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. Refer to Division 1.

B. All installations shall be by qualified personnel regularly engaged in and experienced in this type of Work.

C. Detection and initiating equipment shall be listed by UL or approved by FM.

D. Key all new panels, manual pull stations, etc. to match existing.

3.02 INSTALLATION

A. Install audible and visual signal devices 6 feet 8 inches above floor.

B. Provide steel wire guards at all exterior notification devices as well as in gymnasiums, multipurpose rooms and locker rooms.

C. During installation and testing, and prior to the system being put into service, all manual stations shall be appropriately marked "NOT IN SERVICE" by the Contractor.

D. Wiring to all initiation and signal circuits shall be wired to match existing classification.

E. All wiring shall conform to N.E.C. Articles 725 and 760, and to NFPA-72, "National Fire Alarm Code".

F. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.

G. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.

H. Provide all wiring to post indicator valves and alarm check valves provided by others. Wire into the trouble mode of the fire alarm system.

I. Provide all wiring to the smoke dampers installed by others. Wire to the damper junction box with flexible conduit and wire; provide box or boxes as required. Install according to N.E.C. Article 300-22. Smoke dampers shall operate only when its associated smoke duct detector is in alarm.

J. Audible/Visible Device Installation:

1. Field verify audible alarm type in existing building and provide to match.

2. Devices shall be installed at eighty inches (80") minimum above the floor, or six inches (6") below the ceiling, whichever is lower, in accordance with ADA guidelines.

3. Audible devices intended for operation in public spaces shall have a sound level of not less than seventy-five (75) dBA at ten feet (10'), nor more than 110 dBA at the minimum hearing distance from the device.

4. Audible devices intended for operation in private spaces shall have a sound level of not less than forty-five (45) dBA at ten feet (10'), nor more than 110 dBA at the minimum hearing distance from the device.

5. All audible emergency alarm signals shall be at least 15 dbA over the existing sound level within a space or shall exceed the maximum sound level by 5 dbA for at least 60 seconds, whichever is louder. Within areas occupied by persons with hearing impairments, audible emergency alarms must have the intensity and frequency to provide notification of an alarm condition.

K. Wiring:

1. Install all wiring in accordance with manufacturer's recommendations.

2. All wiring shall be installed in EMT conduit in a separate and segregated system.

3. Install all 120 volt wiring in separate conduit.

4. All exposed wiring shall be installed in EMT conduit or surface raceway. Existing conduit if acceptable may be used. Fire rated cabling may be run above accessible ceilings. Cable in mechanical rooms, crawl spaces and exterior shall be run in conduit.

5. All wiring not in conduits shall be plenum rated and fire rated and installed in a separate bridle ring raceway system, located on 4’ centers.

6. Wiring shall be continuous from device to device. Splicing shall be accomplished by use of terminal blocks in locked cabinets keyed alike with the fire alarm control unit, or junction boxes. No connections or splices shall be made underground.

7. Control cabinets shall not be used as pull boxes or raceways. Wiring gutters and locked terminal cabinets shall be used.

8. The Fire Alarm System wiring shall be installed in a workmanlike manner, subject to the approval of the project manager

9. All harnessing of wires shall be accomplished by use of approved nylon tie wraps.

10. All wiring shall be numbered and color coded in accordance with this Specification.

11. Tests of all wiring shall be conducted for proper connection, continuity, and resistance to ground. The minimum allowable resistance between any two conductors or between conductors and ground is one (1) megohm as checked by a "megger" after all conduit, conductors, detector bases, etc. have been installed, but before the detector devices are plugged into the base or end-of-line devices installed.

L. Routing:

1. All fire alarm system conduits shall be provided either parallel or perpendicular to building structural members.

2. All fire alarm system conduits shall be provided at a height so as not to obstruct any portion of a window, doorway, stairway, or a passageway, and shall not interfere with the operation of any existing mechanical or electrical equipment.

3. All fire alarm system conduits and cable shall be routed to minimize the potential for physical damage, either mechanical or by fire.

4. All fire alarm system junction boxes, pull boxes, terminal cabinets, control enclosures and device backboxes shall be readily accessible for testing, service and maintenance.

M. Mounting and Labeling of Devices:

1. All fire alarm devices shall be rigidly mounted, using appropriate backboxes, to building structural members, permanent walls, ceilings or fixtures designed for the purpose.

2. All devices shall be labeled with device address or device count as appropriate. Label shall be sticky back type attached to base of device. Label identification shall be consistent with As-Built drawings.

N. Color Coding and Wire Numbering:

1. All conductors entering and leaving terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner.

2. All conductors shall be color coded. Color coding shall be by wire insulation, not taping or banding. The numbering and color coding shall be continuous for each circuit wire.

3. Wire shall be coded and number to match existing coding and numbering schemes.

4. Wires shall be numbered at each connection, termination, and junction point. Wire numbering tags shall be Brady Perma-Code, Westline, or equal.

3.03 INTERRUPTIONS TO EXISTING FIRE ALARM SYSTEM

A. Do not remove any portion of the existing fire alarm system from operation while installing new work without written approval of the Project Manager.

B. Student occupied spaces must have existing systems maintained during school operation.

C. In order to accomplish the above requirements, temporary wiring and relocations of some existing and/or new equipment may be necessary. These temporary locations should approved by the project manager and arranged so as to avoid safety problems.

3.04 TESTING

A. Prior to beginning work provide a complete system test by a technicians certified by the system manufacturer. Report any existing problem conditions to the owner.

B. After complete installation of the equipment and submittal of as-built drawings, the Contractor shall perform complete tests of the system. After these tests have been completed, the Contractor shall request final acceptance inspection and tests in the presence of the Project Manager and local authority. Coordination of final acceptance test date and times with those to be present is the responsibility of the Contractor. The Contractor shall demonstrate that all conditions of the plans and specifications have been met. The tests shall include proper operation of all devices and testing of supervised circuits. The installation will be checked against the as-built drawings. The Contractor shall furnish all testing materials and instruments. A punch list will be developed and the Contractor shall correct punch list items. There will be a reinspection of punch list items. If additional reinspections are found necessary to assure compliance with the Contract, they shall be made at the Contractor's expense.

C. Final acceptance tests shall be coordinated by the contractor and performed in the presence of the owners representative as follows:

1. Operation of the fire alarm control panel and indicating components in accordance with factory recommended procedures.

2. Operational tests of all devices (i.e., detector, waterflow indicator, manual pull box, and valve supervisory device) in accordance with the factory recommended procedures.

3. Audible/visible testing of all indicating appliances. Tests shall include sound level (dBa) and light intensity (lumens).

4. Checks of each initiating circuit or device address for correct indications at the control unit, and any remote annunciator. i.e. Operation of the S.T.U. including receipt of the appropriate zoned signal at the Palo Alto Communications Center.

5. A checkout report shall be prepared by the contractor and submitted to the Project Manager. The checkout report shall include a listing of detector sensitivity for each detector. The report shall summarize the results of all tests and shall serve as the contractor's certification that the system is properly installed and fully functioning.

3.05 WARRANTY

A. The complete fire protection system shall be fully tested and guaranteed for a period of one year after Owner's Representative written acceptance.

3.06 COMPLETION AND ACCEPTANCE

A. The complete fire protection system shall be fully tested and guaranteed for a period of one year after Owner's Representative written acceptance

B. Prior to request for final payment submit a quantity of bound Operator Manuals that shall include as a minimum:

1. Shop drawings.

2. Bill of Material.

3. Manufacturer's equipment description for each piece of equipment, each device and each initiation and control module type used.

4. Record Drawings for fire alarm wiring diagrams showing typical connection diagrams for each type of device and a complete riser diagram showing all devices, zones, and wiring requirements. Record Drawings for fire alarm wiring diagram shall show all terminal connections at all panels.

5. Instruction report stating when instruction was given and who was in attendance, signed by the Owner's Representative.

6. Submit a written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved. (Both new and existing systems).

7. One year warranty statement in accordance with the Basic Requirements Section of these specifications.

8. Certificate of Completion as described in NFPA-72, Section 1-7.2.

END OF SECTION

DIVISION 27
COMMUNICATIONS CABLING SPECIFICATIONS (CC)
INDEX

SECTION	TITLE
270310	COMMUNICATIONS CABLING WORK GENERAL
270312	UNIT PRICES
270315	COMMUNICATIONS CABLING SPECIAL REQUIREMENTS
270350	TESTING REPORT SUMMARY
271500	HORIZONTAL CABLING CAT 6 AND 6A

SECTION 270310 - COMMUNICATIONS CABLING WORK - GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

1.02 ALLOWANCES, ALTERNATES AND UNIT PRICES

A. Refer to Division 1 specifications for allowances, alternates and unit prices required as part of this Contract.

1.03 INTENT

A. The intent of the drawings and these specifications is to provide all systems complete and operative. Whether indicated on the drawings and/or included in the specification or not, provide all materials, equipment and labor usually furnished with such systems.

1.04 CONFLICTS

A. If a conflict appears between the Drawings and the Specifications, the Contractor is to contact the Engineer for clarification. In the absence of a clarification by the Engineer, the Contractor must install his work in accordance with the more stringent application.

1.05 DEFINITIONS

A. Provide: Furnish, install and connect.
B. Furnish: Supply material only.
C. EXR: Existing to remain.

1.06 SCOPE OF WORK

A. CC Contractor: This Contractor shall do all work, furnish all labor, tools and equipment necessary for all the Cabling work all as indicated on the drawings and specified herein.

B. General:

1. All cutting and patching.
2. Coordinate with other trades and Owner for all installations.
3. Where indicated, install cable in tray or raceways. If not in tray then provide J-hook supports to building structure.

C. Copper Cable:

1. Preprinted cable markers.
2. Install and terminate copper cables.
3. All copper interconnect and distribution equipment.
4. ***INCLUDE IN BASE BID***
   a) 5 additional Cat 6 cables up to 300 feet long, installed, terminated, tested with ID. These 30 cables will be used and installed at the direction of the owner or engineer during the project. If no additional cables are required during the project, a credit for the unused cables will be issued back to the owner based on the unit price submitted in the RFP.

b) 3 additional Cat 6A cables up to 300 feet long, installed, terminated, tested with ID. These 10 cables will be used and installed at the direction of the owner or engineer during the project. If no additional cables are required during the project, a credit for the unused cables will be issued back to the owner based on the unit price submitted in the RFP.

D. Equipment:

1. Room network connectors.
2. Patch panels with identification.

E. Installation:

1. Where indicated this Contractor shall provide surface raceway and conduit as required for installation of network cabling.

F. Documentation:

1. Detailed riser diagrams indicating all cable identification numbers.
2. Provide specific appropriate drawings in each wire closet.
3. Provide required quantity of project records.

G. Testing:

1. Copper testing.
2. Submit test results documentation to Engineer for review.

H. Training:

1. Provide system familiarization and training periods indicated in specification.

1.07 CONTINUITY OF UTILITY SERVICES

A. It is of paramount importance that each utility service operate continuously and without interruption. Whenever this contractor plans to make changes or alterations to any existing utility service, such plans shall result in no or minimum service interruption or inconvenience to Owner. This contractor shall plan and schedule any change or alteration to an existing utility service with Architect and Owner. Such planning, timing, and/or scheduling shall be approved by both these parties.

1.08 CODES AND STANDARDS

A. All materials, equipment, and installations by this contract shall be in accordance with the latest editions of the following applicable requirements:

1. 2020 New York State Building Code, including all applicable amendments supplements to the following:
   a) 2020 International Building Code
   b) 2020 International Existing Building Code
   c) 2020 International Fire Code
   d) 2020 International Plumbing Code
   e) 2020 International Mechanical Code
   f) 2020 International Fuel Gas Code

2. 2020 Supplement to the New York State Energy Conservation Construction Code including all applicable amendments to the following:
   a) 2020 International Energy Conservation Code
   b) 2013 ASHRAE 90.1

3. 2020 Uniform Code Supplement (May 12, 2020)

4. Conform to requirements of NEMA.

5. Bear label of Underwriters Laboratories, Inc.

6. National Electrical Code NFPA Article 70, latest edition.

7. Local Utility Standards

8. Local Municipal and/or city standards.

9. Conform to requirements of Owner's insurance carriers.

10. Shall be in accordance with other standards as listed elsewhere in the specification.

1.09 SUBMITTALS & SUBMISSION REQUIREMENTS

A. All submittals shall be in accordance with Division 1 requirements, the following requirements listed below, and also as indicated in each specification section. All submittals not complying with the listing above will be returned to the contractor without being reviewed. Rejection by Architect or Engineer of any items submitted shall require resubmittal of acceptable items.

1. Within (30) days after receiving signed contract or notice to proceed, submit to Architect for review complete descriptive dimensional data and ratings for equipment and materials proposed to be furnished and installed. Submit (8) copies of data unless otherwise specified by the architect.

2. All materials submitted shall clearly state the job name and specification section(s) that it applies to.

3. Any package containing more than one piece of equipment or material shall also contain a schedule clearly listing all items in submittal. Schedule page(s) shall also indicate project name and building name.

4. All submittals must be clearly marked using nomenclature used in this specification for proper item identification, schedule of usages, model numbers, construction materials, performance, data, etc.

5. Projects involving multiple buildings must have the submittals separated by building. Submittals in which buildings are combined will not be accepted. (Exception: When specifically approved by engineer, basic materials may be submitted once.)

6. The contractor shall insure that dimensions of equipment to be used conform to the space allocated for the equipment on the drawings.

7. Submittals traced or copied from contract drawings are not acceptable and will be returned without review.

8. In the event material and/or equipment is installed prior to obtaining approval of shop drawings, and in the sole opinion of the Owner's Agent, this material and/or equipment does not meet the specifications, the Contractor shall be liable for the removal and the replacement at no additional cost to the contract.

B. Samples: When requested by Engineer, provide samples of both specified equipment and proposed substitutions for review by the Owner's Agent. Such equipment shall be delivered to a location designated, or erected at the job site as directed. When neither is physically possible, arrange for the Owner's Agent to visit an acceptable site where the proposed equipment can be inspected.

C. Substitutions:

1. Submittals for equipment or materials other than as specified shall be accepted for review by the Owner's agent.

2. Approval of substitute equipment shall be based on functional, physical and aesthetic compatibility to the equipment specified as determined by the Owner's agent and approved by the engineer.

3. Where substitute equipment is approved, the contractor shall be responsible for, and bear the cost of any necessary changes by his trade or other trades to make the system complete and operable.

4. Contractor is fully responsible for providing coordination between all trades affected by equipment substitution.

5. When requested, contractor shall submit layout drawings indicating new dimensions and arrangements of substituted equipment. Layout drawings shall indicate all revisions necessary for all services affected by substitution.

1.10 CUTTING AND PATCHING

A. This contractor shall bear the cost of all cutting and patching required by and for the installation of new work and as required by removal work. This contractor shall perform all cutting and patching unless otherwise indicated on drawings or if directed by the Architect.

B. Patching of fire rated floors, walls, partitions, etc. shall be made using new materials equal to the fire rating of the existing.

C. Should changes, omissions or errors in communications cabling work require cutting, patching or making alterations in any portion of new construction, such work will be performed by GC at this Contractor's expense.

D. Cutting and Patching of roof surfaces and structures shall only be performed by a qualified contractor, as approved by the Architect. The work of this contract shall bear the cost of above mentioned cutting and patching. This contractor shall insure that existing roof warranties remain in force.

E. This contractor shall furnish lintels, sized to accommodate structure above opening, where cutting and patching is to be performed on load bearing walls. Contractor shall obtain written approval for all lintels prior to installation.

F. Cutting shall be done in a manner which will not adversely affect the strength of the building. Holes and openings shall be neatly cut so as to provide a finished appearance and shall be patched around the edge where required for a finished appearance. Provide temporary bracing, shoring, etc. as required.

G. Patching shall be structurally sound and match the existing materials and finish of adjacent materials. Patching is required in finished areas, wherever existing work is removed, at the sides of openings, etc.

H. At the completion of the work, all evidence of alteration will be as inconspicuous as possible.

1.11 FIELD INSPECTION

A. As there are various conditions at the site which do not show on the accompanying drawings, or which are at variance with the conditions indicated on the drawings, it is important that each bidder visit the site and acquaint himself with existing conditions, and take these conditions into consideration when preparing his proposal. Each bidder shall obtain information or make any measurement desired. Lack of knowledge relative to existing conditions will not be allowed as a basis for extra compensation.

B. This contractor and his subcontractors shall inspect existing equipment to remain prior to any of his new work in order to determine that all equipment is in good operating condition. If equipment is found to be lacking components, is inoperable, damaged, etc., contractor shall provide immediate written notice to the Owner. The Owner or his representative shall determine if any additional work is necessary and the method by which any work shall be performed.

1.12 INSTRUCTION SERVICES AND MANUALS

A. Instructions:

1. Provide competent personnel to remain at the jobsite for necessary time to instruct the Owner's personnel in proper operation and maintenance of installation made by this contractor.

2. This contractor shall be responsible for notifying and instructing Owner's personnel on all equipment operations, maintenance requirements, etc. Furnish operating training session(s) for equipment listed.

3. The Owner shall be responsible for establishing an operating and maintenance program for all equipment listed.

B. Training Session: A training session shall be held for each system and/or item listed below:

Item	Description	Training Hours For Each Bldg
1.	Copper Cable Infrastructure	2
2.	Computer Conduit System and Components	2

C. The instruction shall include the following types of information:

1. System overview
2. Major component designation
3. System operation procedures
4. Maintenance scheduling and procedures
5. Provide a list of spare components each system would normally require

D. Services: Provide services required, for all equipment specified under this contract, for a period of (1) year after written acceptance by the Owner.

E. Manuals:

1. Submit (3) sets of Operation and Maintenance manuals. Each set shall contain the manufacturers' data, operating instruction parts catalog and maintenance procedures for each piece of equipment. Include normal maintenance servicing schedule to be performed by the Owner.
   a) For projects containing multiple buildings, manuals shall be submitted separately for each building.

2. See other requirements for manuals listed elsewhere in the specification.

3. Provide a typed schedule of vendors, part numbers, contact numbers for each piece of equipment supplied under this Contract.

1.13 PERMITS, CERTIFICATES AND FEES

A. This Contractor shall obtain and pay for permits, certificates, fees etc. listed below. Costs for permits, fees etc. shall be included in the base bid amount.

1. All required applications and permits to begin work
2. Certificate of inspection including Third-Party Agency.
3. All municipal connection charges
4. All local utility charges (power, telephone, cable, etc.)
5. Fees and charges shall be obtained directly from the respective authority having jurisdiction

1.14 REMOVAL, DISPOSAL AND HAZARDOUS MATERIALS

A. All removed equipment shall be removed from the site and properly disposed of.

B. All hazardous materials must be disposed of in compliance with ENCON and all other regulatory agencies.

C. The Owner may wish to keep certain equipment, therefore, check with Owner before removals to determine what may be salvageable.

1.15 GUARANTEE

A. Contractor shall guarantee all work furnished through this contract including work performed by sub-contractors, for a period of (1) year (unless otherwise noted), from the date of final acceptance. Final acceptance will be determined by Owner's Representative on a per building basis. Contractor agrees to repair or replace any defective work or materials at no additional cost to the Owner. Contractor shall also pay for any damage to other work resulting from repairs to defects. Contractor shall furnish written guarantees to the Owner's agent in accordance with the general conditions.

1.16 INSTALLATION

A. This contractor shall coordinate scheduling and installation of work with other contractors, sub-contractors and other trades. The contractor is also required to coordinate all work with owner supplied materials, direct contracts, and normal building operations, if any.

B. All finished work shall be neat and workmanlike. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade. New systems shall be delivered to Owner complete in perfect working order, tested and balanced in full accordance with plans and specifications. Existing systems shall function in same manner as before this work was performed. Any malfunctions which arise in existing systems as a result of demolition or alteration of parts of such systems shall be corrected.

C. Layout of equipment, accessories and cabling systems is generally diagrammatic unless specifically dimensioned or detailed. Check project drawings and existing site conditions before installing work for interference's as governed by structural or other conditions. Owner reserves the right to make reasonable changes in location of equipment, accessories or systems prior to "roughing-in" without involving additional expense. Exact dimensions shown upon plans will be subject to verification and confirmation of exact conditions at site at time of construction. "Plus or minus" dimensions are shown upon drawing as a guide only. Exact surrounding conditions are governed by final equipment selection and/or other like details.

D. Furnish all new equipment and materials as described herein. Any material, operation, method or device mentioned, listed or noted within this specification, if not specifically mentioned as furnished or installed by others, shall be furnished and installed by this contractor.

1.17 TESTING AND INSPECTION

A. Inspections required for any ordinances, regulations, instructions, laws, rules, standards and practices that require any work to be inspected or tested shall be performed. Contractor shall give Owner, Architect and Engineer timely notice of readiness of work for inspection or testing and the date fixed for said inspection or testing.

B. Required local or municipal inspection processed and present Owner with certificate indicating approval of such governing bodies.

C. Contractor shall submit a written report to Architect, copy to Engineer, on results of each inspection or test on system or equipment supplied. Report shall contain all pertinent information, recommendations, approvals, additional work required, etc.

D. Other testing requirements are listed elsewhere in the specification.

1.18 RECORD DOCUMENTS

A. When required by general conditions, or as required elsewhere in specification, or other Division 1 Sections, this Contractor shall prepare and turn over to Owner's agent record As-built documents. As-built drawings will include actual equipment location layout, service connections, ductwork and piping layouts, valve locations, etc.

B. In all projects, contractor shall provide record drawings of all underground equipment and service runs. As-built drawings for underground work will include dimensions to actual locations finish grade elevations, and actual invert to underground structures equipment and service runs.

1.19 IDENTIFICATION AND NAMEPLATES

A. Provide engraved plastic Nameplates with Epoxy style adhesive to equipment, data and coax locations furnished under this contract. Labels shall have black background, white letters; minimum letter height 1/8" high. Punch tape type labels are not acceptable. Contractor to replace damaged nameplates as required.

B. Adhesive to be Amazing Goop (manufactured by Eclectic) or equal. Adhesive to be applied to entire back surface of nameplate to ensure proper installation. Provide submittal of adhesive to be supplied.

1.20 PENETRATIONS THRU FIRE AND SMOKE RATED CONSTRUCTION

A. All penetrations by this contract through rated construction shall be sealed fire safe by a UL listed approved method.

B. All electrical penetrations through walls, floors, etc. shall be conduit sleeved.

C. All conduit penetrations through fire and smoke rated partitions, walls, floors, etc. shall be installed as follows; penetration shall be oversized 1/2" to 3/4" maximum. This Contractor shall pack with fireproofing insulation, type FS cerablanket. Outside of penetrations shall be caulked and sealed with flame stop V, as manufactured by Flame Stop, Inc.; or an approved equal. Flame stop sealant shall be troweled smooth for finishing as required.

1.21 CONFINED SPACES

A. All work in pipe tunnels, mechanical pits, well manholes, etc. shall be performed by skilled tradesman and laborers with current certification for working in confined space. Contractor shall bear all costs to provide all safety equipment, ventilation, etc. as required by State and Federal Regulations and shall obtain all necessary permits for such work.

B. Contractor shall submit copy of current certifications and photo I.D. of all tradesman and laborers who will be working in confined spaces on this project.

END OF SECTION

SECTION 270312 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 2 Specification Sections apply to this Section.

1.2 SUMMARY

A. This section applies to all contractors.
B. This Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes (if any), and overhead, and profit.
B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 PRODUCTS

(NOT USED)

PART 3 EXECUTION

3.1 LIST OF UNIT PRICES

A. Communication Cabling

B. Unit Price No. CC-1

1. Description: This unit price shall indicate the cost to ADD or DELETE (1) single Category 6A data cable of any length up to 300' including cable, jacks, terminations, testing and labeling and installation labor
.

C. Unit Price CC-2

1. Description: This unit price shall indicate the cost to ADD or DELETE (1) single Category 6 data cable of any length up to 300' including cable, jacks, terminations, testing and labeling and Installation labor.

END OF SECTION

SECTION 270315 - COMMUNICATIONS CABLING SPECIAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SUBMITTALS

A. Contractor qualifications.

B. Test report format and blank forms.

C. Complete riser diagram.

D. Test report booklets (6) copies; all failed cables shall be flagged with a tab on the test report.

E. Written certificate of completion.

1.03 CONTRACTOR'S QUALIFICATIONS

A. Installer shall certify to the Engineer's satisfaction, that they have the necessary knowledge and experience to successfully complete the specified work prior to starting any work. Contractor shall submit to Architect and/or Engineer the requirements listed below.

B. Contractors which do not meet qualifications listed will not be permitted to perform any installation work.

C. Contractor shall have on staff for the previous 12 months, prior to the bid date a Registered Communications Distribution Designer. Submit a copy of current registration information and date of original certification for RCDD.

D. Installers shall have minimum (5) years experience with computer network installations.

E. Installer shall provide to Architect/Engineer, a reference list of (10) recently completed projects of similar size and scope. Reference list shall include detailed description of installers actual work responsibilities. Reference list shall also include contact persons and telephone number for each project.

F. Submit certifications or similar documents indicating technician experience levels regarding communications and computer networking experience.

1.04 PROJECT STANDARDS

A. All equipment and installation methods shall conform to nationally recognized standards.

B. All work shall be in compliance with IEEE Standard 802.

C. All cabling and all components shall be in compliance with EIA/TIA 568, ISO9001, IEC 11801 latest revision.

D. All cabling shall utilize pair to pair and power sum testing methods.

E. Selected installation methods specified herein may include more specific requirements than listed in the above referenced standards. Contractor is instructed to comply with both minimum standards (such as listed above) and any additional items specifically required in these specification sections relating to Computer Network Cabling.

F. All Enhanced Category 6 cable connectors and terminations will comply with EIA/TIA 568, ISO9001 and IEC 11801 Standards; Type B.

1.05 ACCEPTANCE TESTING

A. General: The entire network cabling system shall be fully tested by a qualified Contractor.

B. Testing procedures shall comply with the latest versions of applicable IEEE & EIA/TIA Standards, this section, and specific requirements of other sections of this specification.

C. Architect, Engineer and Owner shall be notified (2) weeks prior to commencement of testing. All testing shall be done in the presence of the Owner's Representative or test will be rejected.

D. Required Instruments: The entire copper cabling system shall be tested with the instrument specified in these specification for the copper system. The fiber optic cabling shall be tested using an Optical Time Domain Reflectometer.

1.06 PAYMENT REQUISITION SPECIAL APPROVAL:

A. Requisition payments of 50% of Contract or $25,000 (whichever is greater) will not be released until testing results are submitted, verified and approved by engineer.

1.07 SPECIAL PROJECT DOCUMENTATION

A. Contractor shall provide individual typed booklets listing each node number and the room number in which it is located for each wiring closet. Provide (1) preliminary set of booklets to Architect/Engineer for approval. After approval provide (2) additional sets of all booklets; one copy shall be located in the corresponding wiring closet. The other complete set shall be turned over to the Owner.

1.08 TESTING REPORTS

A. 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. Contractor shall submit Digital copy of final testing report to Architect/Engineer for all data on USB Thumb drive. For multiple buildings provide (1) copy for each building involved in project.

B. Prior to the start of work, Contractor shall submit test booklet format and blank test report forms for Engineer approval.

C. Report booklet shall include final riser diagrams with cable identification numbers.

D. 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.

E. All individual cable test result sheets shall indicate the following general information:

1. Building Name
2. Testing Company
3. Test Date
4. Type of Test

5. Software Version
6. Cable Identification Number
7. Type of Cable
8. Rack Number
9. Local Building Location
10. Operator's Signature (Testing Company)
11. Test Instrument Calibration Status
12. Witness Signature (Owner's Representative)
13. Test Instrument Set Up Values
14. Pass/Fail Indication

F. Copper Cable:

1. Test result sheet shall indicate, as a minimum, the following information:

2. Test results shall be listed for each individual conductor pair in each cable.

3. Individual test report swept out to 500 MHz for each reel of cable with ACR values for power sum and pair to pair ratings.

4. Cable Testing:
   a) Required Testing Instruments: all copper cable runs are to be tested by the Contractor using a Fluke # DSX2-8000; or equal.

5. Tests shall including the following:
   a) Wiremap
   b) Length
   c) Attenuation to Crosstalk (ACR) Power Sum
   d) Return Loss (RL)
   e) Near End Crosstalk (NEXT) Power Sum
   f) Equal Level Far-End Crosstalk (ELFEXT
   g) Power Sum Attenuation

6. Cable identification number, conductor pair number.

G. Transmitter/Receiver Level Testing: After installation of network electronics, test device transmit levels at source, then test receiver power levels at opposite end of fiber strand. Verify received power level is within operating level of network devices.

H. Certificate of Completion:

1. The Contractor shall certify in writing (6 copies), that the entire network cabling systems is 100% complete, properly installed, in full compliance with IEEE & EIA/TIA Standards, fully tested, and that all documentation has been transmitted to the Owner or his representative.

2. The certificate shall state the Contractor's warrantee for completed work.

END OF SECTION

SECTION 270350 - TESTING REPORT SUMMARY

Building: _____ Cable Type: _____

Test Date: _____ Cable Level: _____

Project #: _____ APN #: _____

Patch Panel ID: _____

Room #	Node #	Test Pass/Fail	ACR / Pair			
			1-2	3-6	4-5	7-8

END OF SECTION

SECTION 27 15 00 HORIZONTAL CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

1.02 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to perform the work required for a complete installation as required in the Contract Documents.

B. Work specified in this section is included in the cabling contract.

C. This section shall include the following:

1. Category 6 and 6A cable
2. Patch Panels
3. Communications Faceplates
4. Termination Jacks

1.03 REFERENCES

A. The products and work herein specified shall comply with the current additions of the following publications and standards.

1. UL - Underwriter Laboratory
2. NEC – National Electric Code
   a) Article 725
   b) Article 770
   c) Article 800
3. NFPA – National Fire Protection Association
4. NECA - Standard of Installation
5. ANSI – American National Standards Institute
6. NEMA – National Electrical Manufactures Association
   a) Article 250
7. EIA – Electronic Industries Alliance
   a) ANSI/TIA/EIA-568-C.2.
   b) ANSI/EIA/TIA 569B
   c) ANSI/EIA/TIA 606A
   d) ANSI-J-STD-607-A
   e) ANSI/TIA/EIA-606-A
8. TIA – Telecommunications Industry Association
9. IEEE C2 National Electrical Safety Code
10. FCC - Federal Communications Commission
    a) CFR 68
11. BICSI – Building Industry Consulting Services International
    a) Distribution Methods Manual
    b) ANSK/NECA/BICSI 568
12. ISO/IEC 11801

B. 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 Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

1.04 QUALITY ASSURANCE

A. All work shall be provided in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents, shall be provided in accordance with industry standards and shall be subject to the control and approval of the Owners representative.

B. Equipment and materials shall be of the quality and manufactures indicated. The equipment specified is based on the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in everyway to that of the equipment specified, and subject to the approval of the Engineer.

C. Strictly adhere to all Category 6 (BICSI and TIA) and manufacturer recommended installation practices when installing high performance cabling.

D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

E. The contractor shall furnish a list of three (3) installations of equivalent or larger systems that have been installed within the past two (2) years and have been operating satisfactorily for a minimum of one year. (Include names and phone numbers of references) with bid.

1.05 SUBMITTALS

A. Provide manufactures cutsheets, specifications, and installation instructions for the products herein specified.

1. Category 6 cable
2. Category 6 Patch Panels
3. Communications Faceplates
4. Wall Phone Faceplates
5. Modular Jacks

B. Termination details for all cable types.

PART 2 – PRODUCTS

2.01 CATEGORY 6 100 OHM UNSHIELDED TWISTED PAIR CABLE

A. The horizontal balanced twisted pair cable shall exceed the Category 6 transmission characteristics per issue of ANSI/TIA/EIA-568-C.2.

B. Shall be independently verified to comply with ANSI/TIA/EIA-568-C.2.

C. An ISO 9002 Certified Manufacturer shall make the cable.

D. Cable shall be UL LISTED.

E. Cable shall be plenum rated

F. Physical Characteristics:

1. Shall be CMP (plenum rated) rated and meet applicable requirements of ANSI/ICEA S-80-576 and NEC.
2. Conductor shall be 23 AWG solid bare annealed copper.
3. Outer jacket colors shall be orange for security cameras, Blue for Data or voice outlets.
4. Category marking shall be printed every one foot. Footage indicators shall also be provide on jacket.
5. The diameter of the insulated conductor shall be .023 in. maximum.
6. Shall consist of (4) 23 AWG twisted pairs.
7. Shall be suitable for the environment in which they are to be installed.
8. The color coding of pairs shall be:

Pair 1	W-BL; BL
Pair 2	W-O; 0
Pair 3	W-G; G
Pair 4	W-BR; BR

9. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
10. Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.

G. Compliance :

1. ANSI/TIA-568-C.2
2. U.L. 444
3. U.L. 1666
4. NFPA 262

H. Impendence - 100 Ohm +/- 15

I. Guaranteed Performance (db/100m)

1. Cable shall exhibit a minimum NEXT of:

Frequency MHz	NEXT
1.0	84.3
4.0	75.3
10.0	69.3
16.0	66.2
20.0	64.8
31.25	61.9
62.5	57.4
100.0	54.3
200	49.8
250	48.3
400	45.3
550	43.2

2. Cable shall exhibit Minimum ELFEXT of:

Frequency MHz	ELFEXT
1.0	76.8
4.0	64.8
10.0	56.8
16.0	52.7
20.0	50.8
31.25	46.9
62.5	40.9
100.0	36.8
200	30.8
250	28.8
400	24.8
550	22.0

3. Cable shall exhibit maximum Insertion loss of:

Frequency MHz	Insertion Loss
1.0	2.0
4.0	3.7
10.0	5.9
16.0	7.4
20.0	8.3
31.25	10.5
62.5	15.1
100.0	19.3
200	28.2
250	31.8
400	41.5
550	49.7

4. Cable shall exhibit minimum ACR minimum of::

Frequency MHz	ACR
1.0	80.3
4.0	69.5
10.0	61.4
16.0	56.8
20.0	54.4
31.25	49.4
62.5	40.3
100.0	33.0
200	19.6
250	14.5
300	9.9

5. Cable shall exhibit PSNEXT minimum of:

Frequency MHz	PSNEXT
1.0	82.3
4.0	73.3
10.0	67.3
16.0	64.2
20.0	62.8
31.25	59.9
62.5	55.4
100.0	52.3
200	47.8
250	46.3
400	43.3

6. Cable shall exhibit minimum return loss::

Frequency MHz	Return Loss
1	20.0
4	23.6
10	26.0
16	26.0
20	26.0
31.25	23.6
32.5	25.0
100	22.5
200	21.0
250	20.5
400	19.5
550	18.8

J. Design Make: Belden Data Twist 3613 non bonded

2.02 CATEGORY 6 CONNECTING HARDWARE

A. Category 6 compliant modular jacks

B. Performance terminated on a 100M length of cable shall match requirements listed for Category 6 cable

C. Physical Characteristics

1. Jacks shall be 8 position un-keyed

2. Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760” x 580”)

3. Jack housings shall be high impact 94 V-0 rated thermoplastic

4. Jacks shall have a temperature rating of -10 °C (14°F) to 60°C (140 °F) in conformance with ANSI/TIA/EIA-568-A

5. Jacks shall utilize a 2 layer printed circuit board to control NEXT

6. Jack housings shall fully encase and protect printed circuit boards and IDC fields.

7. Housing shall be ultrasonically welded for tamper resistance.

8. Modular jack contacts shall accept a minimum of 2500 mating cycles without degradation of electrical or mechanical performance.

9. Contacts will maintain a minimum vertical deflection force of 100 grams over deflection window.

10. Modular jack contact wires shall be formed flat for increased surface contact with mated plugs.

11. Contacts shall be arranged on the PC board in 2 staggered arrays, one array has 6 contacts and the other array has 2 contacts.

12. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.

13. Contact Plating shall be a minimum of 50 micro inches of hard gold in the contact area over 50 micro-inch of nickel.

14. Jack termination shall follow the industry standard 110 IDC.

15. IDC contact termination towers shall be paired and angled at 29.5 degrees.

16. IDC contacts shall be laid out in staggered arrays of 4 sets of 2 contacts.

17. Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code and an abbreviated catalog number.

18. Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.

19. 110 IDC shall utilize 100 micro-inch tin lead plated (60% tin/40%lead) over phosphor bronze over nickel.

20. Jacks shall terminate 22-26 AWG stranded or solid conductors.

21. Jacks shall terminate insulated conductors with outside diameters up to .050”

22. Jacks shall be compatible with single conductor 110 impact termination tools.

23. Jacks shall include translucent wire retention stuffer cap, that hold terminated wires in place and allow the conductors to be visually inspected in the IDC housing.

24. Stuffer cap shall have a positive locking latch to provide conductor strain relief.

25. Stuffer cap used for wire termination with channel lock style pliers.

26. Jacks shall be compatible with TIA/EIA 606 color code labeling

27. Jacks shall accept snap on icons for identification or designation of applications.

28. Jacks shall be available in 6 colors for identification or designation of applications at the workstation or telecommunication room.

29. Jacks shall have universal wiring designation.

30. Jacks shall be marked with the T-568A wiring scheme.

31. Jacks shall have an attached color coded wiring instruction label housed between the IDC termination towers.

32. Jacks shall be manufactured in the USA

33. Jacks shall be designed for 100 Ohm UTP cable termination

34. Jacks shall be UL LISTED 1863 and CSA certified.

35. Jacks shall be made by an ISO 9002 Certified Manufacturer.

D. Design Make: Belden Cat6+

E. Acceptable Manufacturers:

1. Panduit
2. Amp
3. Hubbell

2.03 CATEGORY 6A (625MHZ) 4-PAIR UNSHIELDED TWISTED PAIR CABLE

A. The horizontal balanced twisted pair cable shall exceed the Category 6A transmission characteristics per issue of ANSI/TIA/EIA 568-C.2 Category 6A. Tested to 625MHz.

B. Shall be comply with the following:

1. Category 6A - TIA 568.C.2
2. ISO/IEC 11801 ed 2.1 (2008) Class EA

C. An ISO 9002 Certified Manufacturer shall make the cable.

D. Cable shall be UL LISTED.

E. Physical Characteristics:

1. Cable shall be plenum rated and meet NFPA 262 Plenum Flame Test (UL910)(FT6).

2. Conductor shall be 23 AWG solid bare annealed copper.

3. Nominal Outside Diameter - 0.269 in.

4. Minimum Bend Radius/Minor Axis: 1.200 in.

5. Minimum Bend/Installation: 2.7 in.

6. Maximum Pulling Tension - 40 lbs.

7. Category marking shall be printed every one foot. Footage indicators shall also be provided on jacket.

8. The color coding of pairs shall be:
   a) Pair 1 White/Blue Stripe & Blue
   b) Pair 2 White/Orange Stripe & Orange
   c) Pair 3 White/Green Stripe & Green
   d) Pair 4 White/Brown Stripe & Brown

F. Electrical Characteristics Overall

1. Capacitance (pF/ft) – 17.00
2. Nominal Velocity of Propagation: 68.00%
3. Maximum Delay (ns/100 m) - 537 @ 100MHz
4. Typical Delay Skew (ns/ft)- 35
5. Maximum Delay Skew (ns/100 m) – 45
6. Maximum Conductor DC Resistance @ 20°C (Ohm/100 m) – 7.4
7. Maximum Operating Voltage - UL: 300 V RMS
8. Maximum DCR Unbalanced @ 20°C (%) : 3.000

Electrical Characteristics (Continued)

Frequency (MHz)	Input (Unfitted) Imp. (Ohms)	Fitted Impedance	Min. PSACRF (dB)
1	100+/- 15	100+/- 10	68.8
4	100+/- 15	100+/- 10	56.8
8	100+/- 15	100+/- 10	50.7
10	100+/- 15	100+/- 10	48.8
16	100+/- 15	100+/- 10	44.7
20	100+/- 15	100+/- 10	42.8
25	100+/- 15	100+/- 10	40.8
31.25	100+/- 15	100+/- 10	38.9
62.5	100+/- 15	100+/- 10	32.9
100	100+/- 15	100+/- 10	28.8
200	100+/- 22	100+/- 10	22.8
250	100+/- 22	100+/- 10	20.8
300	100+/- 22	100+/- 10	19.3
350	100+/- 22	100+/- 10	17.9
400	100+/- 22	100+/- 10	16.8
450	100+/- 22	100+/- 10	15.7
500	100+/- 22	100+/- 10	14.8
550	100+/- 22	100+/- 10	14.0
600	100+/- 22	100+/- 10	13.2
625	100+/- 22	100+/- 10	12.9
750			11.3
860			10.1

Frequency (MHz)	Min. PSANEXT (dB)	Min. PSAACRF (dB)	Min. TCL (dB)	Min. ELTCTL (dB)
1.000	67.000	67.100	40.000	35.000
4.000	67.000	67.100	40.000	23.000
8.000	67.000	61.100	40.000	16.900
10.000	67.000	59.200	40.000	15.000
16.000	67.000	55.100	38.000	10.900
20.000	67.000	53.200	37.000	9.000
25.000	67.000	51.200	32.000	7.000
31.250	67.000	49.300	35.100	
62.500	66.600	43.300	32.000	
100.000	63.500	39.200	30.300	
200.000	59.000	33.200	27.000	
250.000	57.500	31.200	26.000	
300.000	56.300	29.700	25.200	
350.000	55.300	28.300	24.600	
400.000	54.500	27.200	24.000	
450.000	53.700	26.100	23.500	
500.000	53.000	25.200	23.000	
550.000	52.400	24.400		
600.000	51.800	23.600		
625.000	51.600	23.300		
750.000	50.400	21.700		
860.000	49.500	20.500		

Frequency (MHz)	Max. Attentuation (dB/100 m)	Min. PSNEXT (dB)	Min. PSACR (dB)	Min. RL (dB)
1	2.100	73.3	71.2	20.000
4	3.800	64.3	60.5	23.000
8	5.300	59.8	54.4	24.500
10	5.900	58.3	52.4	25.000
16	7.500	55.2	47.8	25.000
20	8.400	53.8	45.4	25.000
25	9.400	52.3	43	24.300
31.25	10.500	50.9	40.4	23.600
62.5	15.000	46.4	31.4	21.500
100	19.100	43.3	24.2	20.100
200	27.600	38.8	11.2	18.000
250	31.100	37.3	6.3	17.300
300	34.300	36.1	1.9	16.800
350	37.200	35.1		16.300
400	40.100	34.3		15.900
450	42.700	33.5		15.500
500	45.300	32.8		15.200
550	47.700	32.2		14.900
600	50.100	31.6		14.700
625	51.200	31.4		14.500
750	56.700	30.2		14.000
860	61.200	29.3		13.600

G. Applications

1. 10GBASE-T Full Power Implementation (IEEE 802.3an).

2. 10GBASE-T Low Power Implementation (Short Reach Mode) (IEEE 802.3an).

3. 1000BASE-T Applications (IEEE 802.3ab).

4. Power Over Ethernet Plus - 2 pairs, up to 30 Watts or 4-pairs, up to 60 Watts (IEEE 802.3at).

5. Power Over Ethernet - 2 pairs, up to 12.95 Watts (IEEE 802.3af).

6. Broadband Video (CATV) & High-Speed Internet (DOCSIS) over UTP up to 860 MHz.

7. High Temperature performance up to 50°C without length de-rating for 1000BASE-T and 100BASE-TX.

H. Design Make: Belden 10GXS13

I. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

2.04 CATEGORY 6A MODULAR JACKS

A. ETL - Verified Category 6A

B. Performance terminated on a 100M length of cable shall match requirements listed for Category 6A cable

C. Physical Characteristics:

1. Color as determined by owner and matching attached cable color. Provide different colors for each of the following:
   a) Wireless Access Points - GREEN
   b) Desktop Data and VoIP - BLUE
   c) Security - ORANGE

2. Front Connection Flexible PCB with 50u inch Gold over Nickel.

3. Rear Connection IDC Phosphor Bronze with Tin Plating over Nickel.

4. Connector Body N/A Plastic - UL940V-0

D. Mechanical Characteristics:

1. Footprint/Type: KeyConnect
2. Plug / Jack Compatibility: RJ45,
3. Cable/Connector Retention: 15 lbs.

E. Standards Compliance:

1. FCC Part 68, Subpart F
2. IEC 60603-7
3. ISO/IEC 11801:2002 Amendment 2
4. ACA, Bi-national Standard Listed

F. Electrical Characteristics:

Frequency (MHz)	Max. Insertion Loss TIA* (dB)	Max. Insertion Loss Belden** (dB)	Min. NEXT TIA* (dB)	Min. NEXT Belden** (dB)	Min. FEXT TIA* (dB)	Min. FEXT Belden** (dB)
1.000	0.100	0.050	75.000	77.000	75.000	80.000
4.000	0.100	0.050	75.000	77.000	71.100	75.100
8.000	0.100	0.050	75.000	77.000	65.000	69.000
10.000	0.100	0.050	74.000	77.000	63.100	67.100
16.000	0.100	0.060	69.900	72.900	59.000	63.000
20.000	0.100	0.070	68.000	71.000	57.100	61.100
25.000	0.100	0.080	66.000	69.000	55.100	59.100
31.250	0.110	0.090	64.100	67.100	53.200	57.200
62.500	0.160	0.140	58.100	61.100	47.200	51.200
100.000	0.200	0.180	54.000	57.000	43.100	47.100
200.000	0.280	0.260	48.000	51.000	37.100	41.100
250.000	0.320	0.300	46.000	49.000	35.100	39.100
300.000	0.350	0.330	42.900	46.700	33.600	37.600
400.000	0.400	0.380	37.900	42.900	31.100	35.100
500.000	0.450	0.430	34.000	40.000	29.100	33.100
625.000		0.480		37.100		31.200
Mated Connection Table - Footnote: *TIA/EIA-568-B.2-10-2008 Category 6A Standard.						
****Worst-case performance for a 10GX mated connection using 10GX modular plugs.**						

Frequency (MHz)	Max. Return Loss TIA* (dB)	Max. Return Loss Belden** (dB)	Min. PSANEXT TIA* (dB)	Min. PSANEXT Belden** (dB)	Min. PSAACRF TIA* (dB)	Min. PSAACRF Belden** (dB)	Min. Balanced TCL TIA* (dB)	Min. Balanced TCL Belden** (dB)
1.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
4.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
8.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
10.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
16.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
20.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
25.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
31.250	30.000	34.100	70.500	72.000	67.000	72.000	38.100	45.000
62.500	30.000	34.100	70.500	72.000	67.000	72.000	32.100	39.100
100.000	28.000	30.000	70.500	72.000	67.000	72.000	28.000	35.000
200.000	22.000	24.000	64.500	66.000	61.000	66.000	22.000	29.000
250.000	20.000	22.000	62.500	64.000	59.000	64.000	20.000	27.000
300.000	18.500	20.500	61.000	62.500	57.500	62.500	18.500	25.500
400.000	16.000	18.000	58.500	60.000	55.000	60.000	16.000	23.000
500.000	14.000	16.000	56.500	58.000	53.000	58.000	14.000	21.000
625.000		13.000		56.100		56.100		19.100
Dielectric Strength: 1,000 V RMS @ 60 Hz for 1 minute								
Current Rating: 1.500 A								
Insulation Resistance: 50 M-Ohm Minimum								
Max. Contact Rsitance: 20 m-Ohm								
Termination Resistance: 2.5 m -OHM								

G. Design Make: Belden 10GX Modular Jack, Category 6A, RJ45, Key Connect style.

H. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

2.05 CATEGORY 6A UTP PATCH PANELS

A. Characteristics:

1. Steel housing
2. 24 or 48 ports as required by the installation
3. Shall be Blank modular panels to accept snap in RJ-45 COLOR CODED jacks as specified in this specification, color to match the attached data cable.
4. Plug / Jack Compatibility - RJ45
5. Refer to modular jack specification for transmission Characteristics.

B. Standards:

1. FCC Part 68, Subpart F, IEC 60603-7
2. ISO/IEC 11801:2002 Amendment 2

C. Design Make: Belden 10GX Patch Panel - KeyConnect

D. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

2.06 FACE PLATES

A. Provide 106 Adapters with faceplate per detail.

B. Configured to fit standard single gang outlet box.

C. Accepts all IC107 modules.

D. Rugged and durable ABS plastic construction.

E. UL listed.

F. Acceptable Manufacturers:

1. ICC
2. Belden
3. Panduit

2.07 CABLE IDENTIFICATION:

A. All cables terminated in classrooms and wiring closets shall be identified with laser wire markers. Wire markers shall be factory printed on vinyl cloth or film with a self adhesive, self-laminating wrap or permanent locking cable tie. Wrap type markers shall be minimum 1-1/2" long.

B. Contractor shall submit to Engineer product data and samples of wire markers intended for use on this project.

C. Cable identification shall be 6 digit numbers corresponding to wiring closet, patch panel, port number and drop number, refer to Drawing Legend.

D. Furnish Laser Printable Labels (PLL) with lamination Panduit Co.; or equal.

E. Identification numbers hand written by marking pen directly on cable jacket are not acceptable!!!

F. Wrap type markers shall be completely wrapped around cable OD. Application of markers using "tabbed" or "flagged" methods are not acceptable.

PART 3 - INSTALLATION

3.01 GENERAL

A. Firestop conduit openings after the cable installation is complete.

B. Separation from Electromagnetic Interference

Condition	Minimum Separation Distance
Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways.	610 mm (24 in)
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	305 mm (12 in)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal pathway.	152 mm (6 in)
Electrical motors and transformers.	1194 mm (47 in)

C. Installing cables above suspended ceilings

1. Pull or place cables into the zone pathway.

2. Leave sufficient slack in the ceiling to reach any telecommunications outlet/connector within the zone.

3. Where zone pathways are not provided, divide the floor area into direct-run telecommunications zones.

4. Run all the cables to the center point of their zones.

5. From the center point of each zone, distribute the cables to work areas within that zone.

6. At the center point of each telecommunications zone, support all cables with a cable tie or similar device. Tightly cinched cable ties may have a detrimental effect on transmission performance and should be avoided.

7. Coil in a figure eight any cable that is not in service back to the end of the zone pathway. When required, cable-tie these coiled cables.

8. Label the cables and pathways for easy recognition and establish a working database for ongoing identification and maintenance of horizontal cables and pathways.

9. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 inch intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

D. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-B maximum fill for the particular raceway type.

E. Riser rated cable shall be installed in metallic conduit when installed in a plenum space.

F. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.2 document, manufacturer's recommendations and best industry practices.

3.02 UTP CABLE

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.2 document, manufacturer's recommendations and best industry practices.

B. All wiring concealed in new walls or soffits shall be installed in metal conduits.

C. Wiring in existing walls with hollow cavities may be installed loose.

D. All exposed wiring shall be installed in surface metal raceway.

E. All wiring above ceilings shall be installed in cable tray or open top cable hangers and brackets.

F. Cable hangers above accessible ceilings shall be installed 4' on center attached to building structure. If cables have more than 12” of sag, install more hangers.

G. Do not untwist cable pairs more than 0.5 in. when terminating.

H. The Contractor shall be responsible for replacing all cables that do not pass required bandwidth and throughput tests.

I. Maximum length shall be 90 meters. (295 ft).

J. Maximum patch cable shall be 5 meters (16 ft).

K. Provide 10 ft service loop in the communications equipment room. Provide 3 foot service loop in ceiling above outlet. Slack should not be stored in bundled loops. Cable loops have had a degrading effect on cabling performance. Cable slack should be stored in an extended loop or in a figure-eight configuration to alleviate stress.

L. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket. Cables with defects shall be replaced.

M. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90o sweeps at all vertical drops.

N. Do not tie-rap cable to a perpendicular support. Tie-raps shall be used to secure cables to other like cables or to an approved tie mount. Do not over tighten cable ties.

O. Install category 6 cable in a separate open cable hanger segment. Do not install with coaxial, optical fiber cable or any other cable type. If cables have more than 12” of sag, install more hangers.

P. Do not install UTP cable with more than 110N (25 lbs) pull force, as specified in EIA/TIA and BICSII TDDM practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on: long pulls inside conduit, pulls of multiple cables into a single small bore conduit, on conduit runs greater than 100 lineal feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends. Use of tensile rated cords (i.e. fishing line) should be used for difficult or questionable pulls - to judge to go/no-go condition of the conduit and pulling setup.

Q. Care must be taken so that the cable does not bend at any location to a radius less than ten times the diameter of the cable. A cable feeder guide of suitable dimensions should be used between the cable reel and the face of the duct to protect the cable and guide it into the duct as it is payed off the reel.

R. As the cable is payed off the reel, it should be carefully watched and inspected for sheath defects. If defects are noticed, the pulling operation should be stopped immediately and the Engineer promptly notified of the defect. Kinks and/or other irregularities in the cable sheath should be removed or corrected as directed by the engineer.

S. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

T. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

U. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

V. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.

W. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

X. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

Y. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

Z. Each cable shall be clearly labeled on the cable jacket behind the termination device 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.

3.03 UTP MODULAR JACKS

A. All cables shall be terminated with modular jacks that snap into a faceplate mounted on a wall outlet box, surface raceways or power pole.

B. Outlet boxes shall be secured to building with mechanical fasteners. Adhesive fasteners are not allowed.

C. Jacks shall be installed to provide minimal signal impairment by preserving wire pair twists as close as possible to the point of mechanical termination. The amount of untwisted in a pair as a result of termination to the jack shall be no greater than 0.5 inches (13mm).

D. Jacks shall be installed according to manufacturer's instructions and properly mounted in plates, frames, housings or other appropriate mounting device.

E. Jacks shall be installed such that cables terminated to the jacks maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.

F. All extra openings to be filled with blank inserts.

G. Terminate cable per EIA/TIA T-568B standard pin assignments.

H. Remove only as much cable jacket as is required for termination and trimming. Follow the manufacturer's instructions for mounting, termination, and cable management. Minimize the amount of untwisting in a pair as a result of termination to connecting hardware. For untwisting cabling, maintain pair twists as close as possible to the termination point. The amount of untwisting must not exceed 12.7 mm (0.5 in) for category 5e and higher cables.

3.04 TESTING

A. Refer to Sections 270315 & 271600.

3.05 COMPLETION AND ACCEPTANCE

A. In all spaces that have had floor or wall penetrations, hammer drilling, or core boring activities - a through brooming, vacuuming, and wet mopping/sponging shall be preformed. Cleaning shall include floors, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, per manufacturer recommendations.

B. Submit copies of the following:

1. Cable Test Reports (at substantial completion).

3.06 PATCH PANELS.

A. Panels shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to the patch panel shall be no greater than 0.5 inches (13 mm).

B. Panels shall be installed according to manufacturer's instructions and properly mounted to a rack, cabinet, bracket or other appropriate mounting device.

C. Panels shall be installed such that cables terminated to the panel can maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts.

D. Cables shall be terminated on the panels such that there is no tension on the conductors in the termination contacts. Panels shall be properly labeled on front and back with the cable number and port connections for each port, as per cable schedule drawings.

E. All cables shall be neatly “dressed out” in equipment rooms. Cables to be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

F. 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 a bundle, where the label is obscured from view shall not be acceptable.

G. Install factory supplied patch panel labels, in the corresponding T568B configuration, in all UTP patch panels, BEFORE beginning to terminate cables. Cables terminated onto a patch panel without said port label strip shall not be acceptable.

H. The cable jacket shall be maintained as close as possible to the termination point.

3.07 COLOR CODING

A. Prior to submitting cable and connector cuts for approval confirm with the owners IT director the required cable and jack colors.

3.08 CEILING TILES

A. The cabling contractor shall replace all ceiling tiles that are damaged due to cable installation. Tiles shall match the existing.

B. Prior to beginning work walk the proposed cable routes and document any existing damage with the construction manager.

3.09 ATTACHMENT CABLES:

A. Attachment cable assemblies, for use between workstation and room data connector, attenuation requirements ANSI/TIA/ EIA-568A, ISO9001, ISO/IEC 11081. Cables shall be Category 6, 24 AWG stranded conductors, #RJ45 connectors at each end.

B. Contractor shall furnish (1) attachment cable for each room data drop, cable length shall be as noted below unless noted otherwise on Drawings.

	Length
Classroom (Standard Rm.)	10'-0"
Office/Administrative Areas	7'-0"

Note: Provide any additional attachment cables with strain relief boots for completion. Refer to Technology Room Layouts on Contract Drawings for quantity and length required.

3.10 CABLE IDENTIFICATION:

A. All cables terminated in classrooms and wiring closets shall be identified with laser wire markers. Wire markers shall be factory printed on vinyl cloth or film with a self-adhesive, self-laminating wrap or permanent locking cable tie. Wrap type markers shall be minimum 1-1/2" long.

B. Contractor shall submit to Engineer product data and samples of wire markers intended for use on this project.

C. Cable identification shall be 6 digit numbers corresponding to wiring closet, patch panel, port number and drop number, refer to Drawing Legend.

D. Furnish Laser Printable Labels (PLL) with lamination Panduit Co.; or equal.

E. Identification numbers hand written by marking pen directly on cable jacket are not acceptable!!!

F. Wrap type markers shall be completely wrapped around cable OD. Application of markers using "tabbed" or "flagged" methods are not acceptable.

END OF SECTION